Operator's Manual

SD390 - 8-30
Dynamic Signal Analyzer

Scientific Atlanta

Signal Processing Systems

MP MASTER

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SERIAL 1491054

Operator's Manual

SD390 - 8 - 30
Dynamic Signal Analyzer

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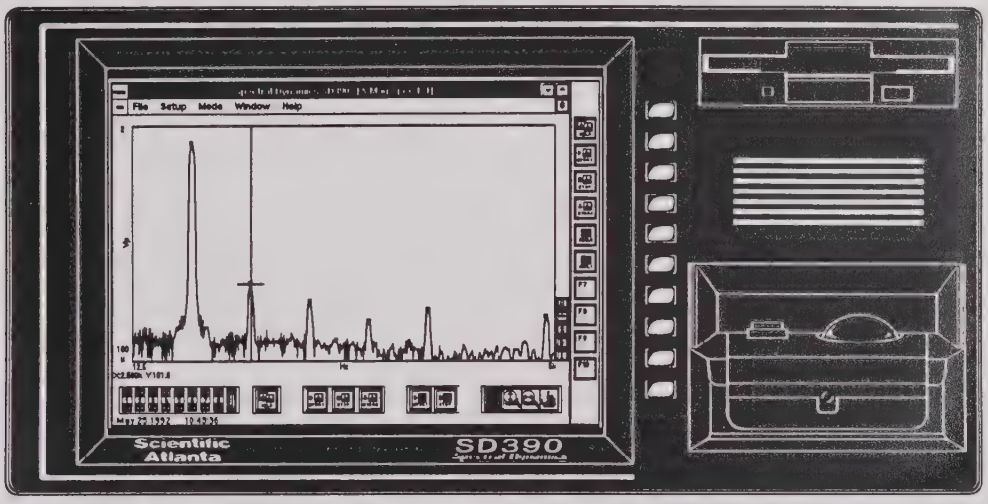
Section 1 - Introduction

Overview



The SD390 is a sophisticated 2 - 8 channel , 100 kHz analyzer that allows Live acquisition, analysis and display of waveform signals, and post-processing (playback) of acquired data. The SD390 is a completely self-contained system capable of various types of analyses for applications in mechanical vibration, acoustics, structural (modal), rotating machinery, and general test and measurement. You can choose from many options and operating modes to suit your particular requirements.

In addition to the standard features included with your instrument, additional options are available and may be installed in your particular configuration. These features are:

- **Octave Analysis**
- **Signature Ratio Analysis (SRA) and External Sampling**
- **Signal Source Generation (SSG)**
- **SMS Modal Analysis Interface**

If these features are not installed, they will appear as *inactive* selections on the menus or with the dialogs.

All features of the SD390 are accessed from pull down Menus. Parameters are selected via DIALOG BOXES, and functions are selected by software "control" buttons and pushbuttons on the front panel.

All choices and parameter entries can be made solely with the Trackball and Trackball Selector button, or you can use an optional mouse and keyboard. Where alphanumeric entry is required, a Virtual Keyboard is available that only uses the Trackball and Selector button.

Integral with the SD390 are the Microsoft® Windows™ and DOS operating systems. Although not a requirement for operating the SD390, certain Windows features can enhance the versatility of the SD390. This manual concentrates on the features and operating modes of the SD390. Information on Windows and DOS can be found in other manuals supplied with this system.

Color or shades of gray (red) schemes for the SD390 use the setting created by the Windows Control Panel. These colors can effect the visibility of options and controls. The default SD390 color selection is optimized for the gas plasma display. Alternate color settings can be created by using the color settings in the **Windows Control Panel.**

Getting Started

To operate the SD390, use the Trackball to move to one of the four function areas of the SD390.

- **Main Menus**
- **Function Keys and Controls**
- **Displays**
- **Status Area**

Once you have selected a function area, use the Trackball Selector button to choose the desired operation.

Main Menus

You select functions from these Menus by moving the selector cursor (indicated by an arrow) to the desired menu by moving the trackball, then select the desired menu function by pressing the Trackball Selector button. Menu functions may invoke an operation, or present a DIALOG BOX. Parameter entry into a dialog box is made by using the Trackball to scroll through predefined choices, or selecting options, or by entering alphanumeric responses. Parameters are validated, and the SD390 provides "hints" if you attempt to enter incorrect parameters. All dialogs are then confirmed (OK), or canceled without modification by moving the Selector Cursor to the appropriate response and pressing the Trackball Selector button.

Function Keys and Controls

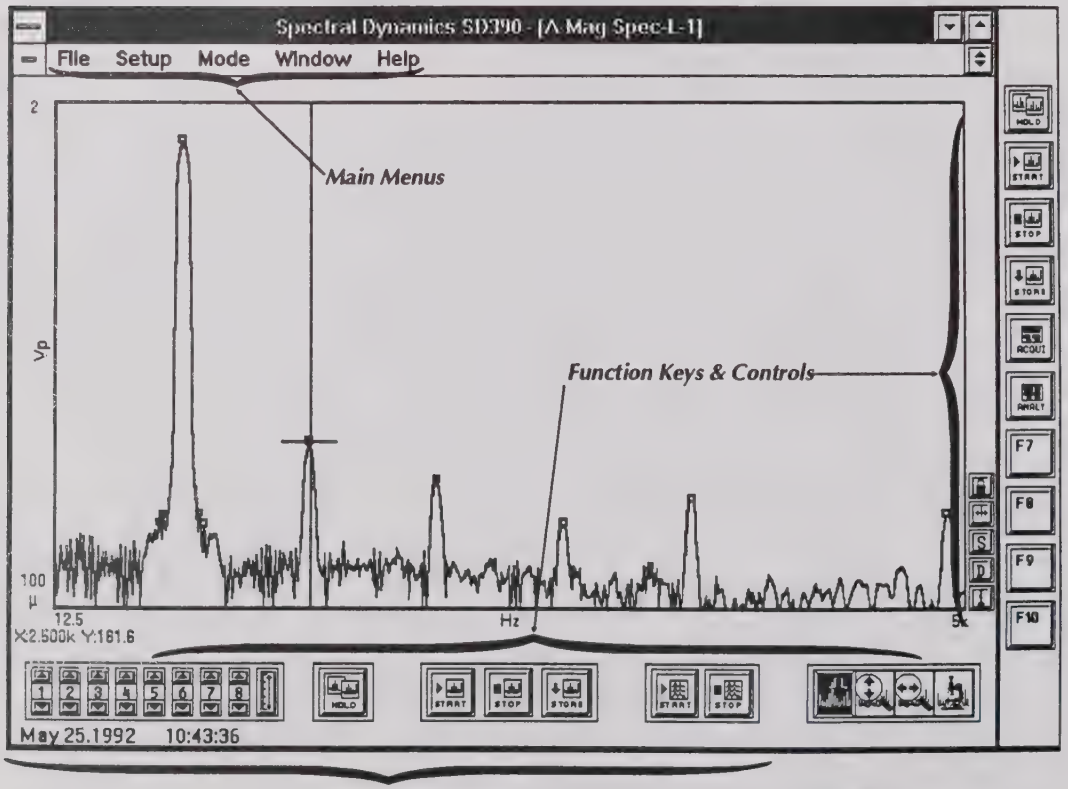
Function Keys and Controls are accessed by moving the Selector Cursor over the desired function or control, then pressing the Trackball Selector button. A visual cue, such as a change in function key color or function name such as Update to Hold, or specific identifiers such as a change from the Selector Cursor to a Frequency Indicator or Line Cursor, will result from a valid action.

Displays

Up to 9 simultaneous data displays (called traces) can be created in virtually any format, size and style. You have complete control over the viewing area and can maximize or iconize any Trace, and change any Trace parameter at any time. Trace Windows also contain their own specific display controls that cause specified action local to the selected Trace Window.

Status Area

The status area is to provide information. There are no user actions resulting from moving the Selector Cursor in this area.



Status Area (Date, Time & RPM if SRA Option is installed)

Operating Modes

The SD390 can operate from two signal sources:

Live acquisition from analog signal sources,
and
Playback of previously acquired (recorded) digital data residing on internal disk storage. The analyzer can also operate in various Analysis Modes allowing selection of the most appropriate method of data collection and analysis.

Data Source

Live Acquisition

The SD390 is provided with a factory default system configuration which initializes acquisition, analysis and display parameters. When first turned on, the SD390 uses this configuration and starts operating in Live Acquisition mode. You may then control analyzer functions by using the various controls such as Update/Hold, AVG Start, selecting frequency span, etc., or reconfigure any of the SD390's parameters such as display type, analysis resolution, acquisition mode, etc., to suit your particular requirements.

When in the Update mode, time domain data is continually acquired into the SD390's Extended Recorder Memory, and processed on a block basis (determined by FFT spectral resolution and overlap), which is controlled by a digitizing clock and trigger. As data is being acquired, LIVE spectral processing and averaging can occur, creating data "sources" for display. All calculated and displayed data is in 32 bit floating point precision, yielding a dynamic range in excess of 90 dB.

Although the data is acquired into each channel's recorder memory at precisely the same time, data is displayed in each trace display window serially while the SD390 is in Update. This may result in the appearance of non-coherent data. However, as soon as the system is placed in Hold, all active display windows are updated with synchronous, coherent data from the same instant in time. When using single triggered mode, the system is placed into Hold after the trigger event is detected.

In the FFT mode, the SD390 can achieve a sampling rate of 256 kHz for 2 channels, yielding an effecting spectral frequency range of 100 kHz for 2 channels. For 3 or more channels, the highest frequency range is 40 kHz. In Octave the mode, the maximum center frequency for the top band of the selected analysis is 20 kHz.

Playback

Live acquisition and processing occurs while the SD390 is in Update mode. When placed in Hold, the SD390 can enter playback mode in order to review or reanalyze data that has been stored in the Extended Recorder Memory.

Instead of acquiring live data from a signal source, data is "played back" from the Extended Recorder Memory, and all analysis and display functions are available as though the data was live. The only restraint is that there has been a finite amount of data recorded, and certain functions stop automatically when the end of data is encountered.

Playback mode is entered by manipulating the standard cursor on Compressed Time Displays (displays that show the contents of the Extended Recorder Memory). Positioning the cursor places an internal pointer at the start of the desired block of data, and all appropriate analyses are performed and displays are updated to reflect the information contained in the specified block. Multiple blocks can be reviewed manually, or automatically by setting limits.

Analysis Modes

Different Modes of collecting and analyzing data can be specified by using the Mode Selector from the SD390's Main Menu. The standard modes are FFT based analysis modes, which include optimizing Spectrum modes to provide increased real-time efficiency. If the Octave Analysis Option is installed, the Octave filter based analysis mode is also available. The Extended Recorder is available in all modes, except the Octave mode. Time domain displays are inhibited in the Octave mode.

Cross Properties

This is the default mode which results in the most versatile use of the SD390 in spectrum mode, in that all analyses and displays (except for sync spectra) are available. The Cross Properties Averager is enabled, which allows averaging of Power and Cross Property data.

Octave (Option)

This mode enables Octave analysis in place of Spectrum analysis. Discrete digital filters are used to compute the amplitude levels of the selected bands. Only Octave Spectrum displays are available.

Spectrum

This mode is used when only Time and Spectral data is required. It conserves internal resources, and allows very high real time rates for Live and Averaged spectral processing. It is also the method of choice when Zoom is required on Power Spectrum data.

Sync Spectrum

This mode is used when Time Synchronized averaging is required. The Time domain Averager is enabled, and Live Time, Spectrum and Averaged Sync Spectrum data are available.

Extended Recorder Memory

The SD390 has a very large dynamic memory pool, which can be used for different purposes in different Analysis Modes. The amount of selected memory, in addition to the selected mode, can provide increased performance of the analyzer for particular measurements.

The Extended Recorder Memory (XRec) of the SD390 can contain over 400,000 samples of time domain data (for 1 MB configurations) to 1.8 million samples of time domain data (for 4 MB configurations) depending upon selected analysis parameters. The total amount of available XRec Memory is divided by the number of active channels, and is user selectable from 8192 samples to the maximum displayed on the Analysis Dialog for a specific setup. In addition to recording time data to internal memory for playback or storage, the selection of the amount of available XRec memory will influence the level of zoom above 10 kHz, the number of octaves above 20 kHz, and the delay for triggering. (For more information on these topics, see *More On Extended Memory*).

Incoming signals are digitized and entered into Extended Recorder Memory on a continuous basis while the SD390 is in Update mode. Extended Recorder Memory is a "circular buffer", meaning that when the last location is filled, data "wraps around" to the beginning of memory so that the Extended Recorder Memory always contains the most recent data. When the SD390 is placed in Hold, the Extended Recorder Memory is "unwrapped" so that the most recent data appears to the right on a time trace, and block 0 is the least recent block that will be processed.

In the Free Run Trigger mode for frequencies less than 40 kHz, data continues to fill the Extended Recorder Memory until Hold is pressed. When the SD390 is operating at 40 kHz or 100 kHz, only 1 BLOCK of data is acquired into Extended Recorder Memory. In any triggered mode, for ALL frequencies, data is acquired into Extended Recorder Memory until a trigger event (the trigger plus the specified delay) is detected. For Single Trigger, acquisition stops when the XRec buffer is full, after the trigger event is detected, and the SD390 automatically goes into Hold. For Multiple Trigger, the trigger event is processed and acquisition continues.

As trigger events can be random, the Extended Recorder Memory may contain varying trigger events when the event is less than the size of XRec. You cannot calculate the number of events from the block size and delay, when using Multiple Trigger.

To fill the Extended Recorder Memory in the 40 kHz and 100 kHz modes, use Single Trigger Mode and set the Delay to the negative number of desired samples. Be sure to set the Trigger Threshold to a value that will ensure that acquisition begins when Update is pressed. Acquisition will automatically stop when the number of samples, plus one block, have been acquired.

☞ *Additional topics on Extended Recorder Memory can be found in Section 8, Reference.*

Waterfall Memory

When the Waterfall Mode is enabled, the available System Memory can be divided between Extended Recorder Memory and Waterfall Memory as a percentage of total analyzer memory. This enables you to optimize memory usage for the type of analysis required, or to devote all of the SD390's memory to store waterfall data.

Waterfall data is stored in memory as precision data resulting from an analysis operation. The results from a one block analysis is stored as one waterfall record. Any number of active channels can be waterfalled simultaneously (and in addition to other analyzer operations), but only one analysis type, or waterfall function, can be processed during a waterfall load operation.

There are many options as to how data is loaded into waterfall memory, and a versatile array of display features for retrieving data from waterfall memory. Data in waterfall memory can be stored to disk, and later recalled from disk for further analysis.

Like the Extended Recorder Memory, Waterfall Memory is a dynamically allocated resource, and the amount of Waterfall memory will vary depending upon system configuration, the number of active channels, and other Analysis and Acquisition parameters.

Data Buffers

Overview

In addition to Extended Recorder Memory and Waterfall Memory there are three classes of data storage, or memory areas that contain data that has been converted from the Extended Recorder Memory to the specified units, or calculated quantities:

- **Live, or Real Time**
- **Averaged**
- **Stored Average, or Store**

The number and size of these internal data areas are dynamically allocated based on the selected Analysis Mode and parameters set on the Analysis Setup Dialog. The contents of these buffers may be cleared when the mode changes, or particular analysis parameters change.

Just as important, selecting the appropriate Analysis Mode will affect the types of analyses and displays that can be produced, and determines the real time rate of the SD390. The three standard Mode selections are:

Cross Properties

This is the default mode that results in the most versatile use of the SD390 in spectrum mode, in that all analyses and displays (except for sync spectra) are available. Published real time rates for the SD390 are for this mode.

Spectrum

This mode is used when only Time and Spectral data is required. It conserves internal resources, and allows very high real time rates for Live and Averaged spectral processing.

Sync Spectrum

This mode is used when Time Synchronized averaging is required.

If the Octave Analysis Option is installed:

Octave

This mode enables Octave analysis. Discrete digital filters are used to compute the amplitude levels of the selected bands.

At a minimum, the Live Time Data Buffer is always available. This allows Live Displays of all analyses except those that do not produce meaningful data unless averaged, such as Transfer Function and Coherence.

See the section on **Display Setup** for a table of valid Domain/Display selections. When you set parameters for **Display Windows**, only the valid choices of displays based on the selected Averager Domain are presented.

The following table shows which Analysis parameters invalidate the indicated Data Buffers.

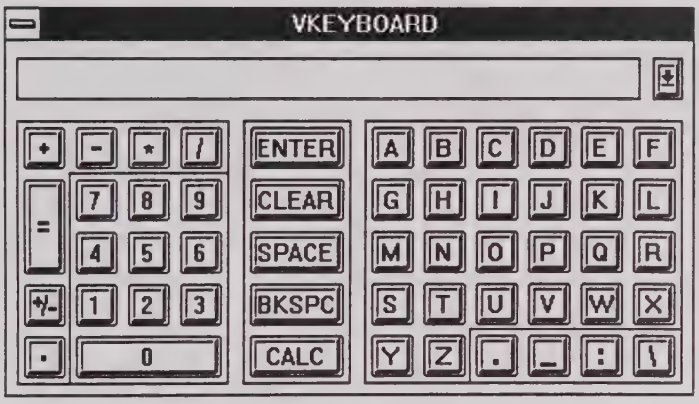
Parameter	Invalidates Data For:
Active Channel List	Extended Recorder, Live
Block Size, Resolution	Averager
Weighting	Averager
Overlap	Averager
Averaging Method	Averager
Averager Domain	Averager

☞ *Changing Analysis modes will invalidate the data in the Live and Averager Buffers. Also, when the data buffer becomes invalid, a descriptive message will appear in the appropriate display window.*

SD390 Hint

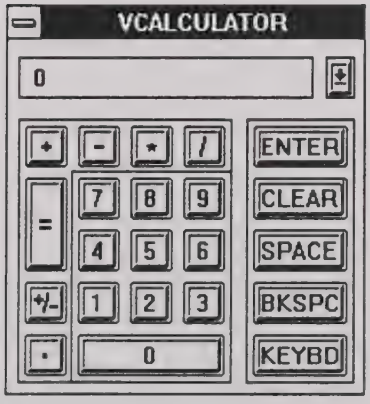
Changing any of the parameters that affect the Averager Memory will cause the contents of the Averager to be lost as soon as "OK" is selected from the Setup Dialog. To retain the contents of the Averager, select AVERAGE STORE before changing the parameter(s). Of course, this will replace the *current* contents of the Store memory.

Virtual Keyboard & Virtual Calculator



The virtual keyboard is a template of alphanumeric characters that can be selected using the Trackball Cursor and Selector Button. Whenever text entry is required, double click on the text entry box of the dialog to invoke the virtual keyboard. Then, position the Trackball cursor arrow over the desired character, and press the selector button to select the character. When all the desired characters are selected, place the arrow cursor over the ENTER key, and press the selector button to enter the characters.

You can use BKSPC to delete characters, or CLEAR to delete all characters. If you want to exit the Virtual Keyboard without modifying the existing text, click on the Virtual Keyboard's close icon located at the top left of the Virtual Keyboard window.



Whenever numeric entry is required, the Virtual Calculator can be used instead of the Virtual Keyboard. The Virtual Calculator operates similarly to a desktop calculator, and allows you to enter numeric values, or compute numeric quantities, which can be used as parameters. You may switch between the Virtual Keyboard and the Virtual Calculator by using the KEYBD and CALC buttons on the respective Virtual device.

Files

Various files can be created and used by the SD390. These files are in two categories:

- **Configuration Files**
- **Data Files**

Configuration Files

These files store the Acquisition Setup, Waterfall Setup, Display Setup and Analysis Setup parameters. The SD390 convention is to append **".CFG"** to the name of configuration files. The SD390 can maintain multiple configurations, and configurations can be switched at any time.

☞ *Configuration files are for use only with the* **Save** *and* **Open** *Configuration commands.*

Data Files

There are four types of data files:

- **Trace Files**
- **Export Files**
- **Extended Recorder Files**
- **Waterfall Data Files**

Trace Files

Trace files contain the data and Display Setup parameters from Trace Display Windows. The data is maintained in internal format for use by the Save and Open Data commands. Data is stored with default parameters that were set when the data was saved. When Trace files are recalled, scaling and display parameters may be changed, but the data itself cannot be modified.

The SD390 convention is to append **".TRC"** to the name of trace data files. These files contain a text header that describes the data in the file. This header can be viewed by a text formatting utility, such as TYPE.

Export Files

Export Files are similar to Trace Files in that they contain data from a Trace Display Window, but they do not contain setup information and they are in ASCII format. As the files are ASCII, they can be easily read by other programs, or exported to other systems. The SD390 convention is to append **".TXT"** to the name of data export files.

Extended Recorder Files

Extended Recorder Files contain binary data of the contents of Extended Recorder Memory. Also included with the data are the Acquisition Setup and Analysis Setup parameters that were in effect when the data was saved. These files can be fairly large, and should be carefully managed.

These files are used by the Save and Load XRec commands. The SD390 convention is to append **".XRC"** to the name of these files.

Waterfall Data Files

Waterfall Data Files contain binary data of the contents of Waterfall Memory. Also included with the data are the Acquisition Setup and Analysis Setup parameters that were in effect when the data was saved. These files can be fairly large, and should be carefully managed.

These files are used by the Save and Load Waterfall commands. The SD390 convention is to append **".WFL"** to the name of these files.

All of these files must be managed by DOS or Windows file management utilities. The SD390 allows creation and use of these files, but you are responsible for deleting, archiving or transferring these files.

SD390 Hint

All data files have an ASCII header that can be viewed via the DOS "type" command, or by a Windows utility such as the notepad.

SD390 Specifications

Input

Full Scale Voltage Ranges	0.01 Vrms to 20 Vrms in a 1, 2, 5 sequence with autoranging.
Impedance	1 Megohm shunted by less than 100 picofarads
Coupling	DC or AC (-3 dB at 0.5 Hz)
A/D Conversion	16 bits each channel, up to 102.4 kHz sample frequency.
Recorder Memory	Standard configuration, 385 k samples distributed between active channels. Optional configuration, 1,850 k samples distributed between active channels.
Overload Protection	100 Vpk on each channel

Triggering

Internally selectable for any channel, single or repeat. External single or repeat.

Frequency Characteristics

Number of Channels	2, 4, 6 or 8
Frequency Ranges	DC to 100 kHz full scale in a 1, 2, 4, 5 sequence with two channels active. DC to 40 kHz full scale in a 1, 2, 4, 5 sequence with four to eight channels active.

Analysis Performance

Dynamic Range	Greater than 80 dB with 8 averages on 0.05 Vrms to 20 Vrms.
Noise Floor	Greater than 90 dB below full scale 0.1 V to 20 V full scale.
Weighting Functions	Rectangular, Hanning, Harris flat-top, and Exponential Response with variable tau.
Overlap Processing	Maximum overlap in real-time mode. Selectable 0, 25%, 50%, 75%, 90% or maximum for extended memory readout.
Frequency Resolution	200, 400, 800, or 1600 lines, selectable.

Real Time Performance	Greater than 20 kHz real time rate in dual channel operation.
Phase Offset	±180° for all channels

Functions Performed

Time Domain	Input memory for any channel or group (variable block length).
	Compressed input memory (up to 770 KB) for any channel.
	Sync time average for any channel or group.
	Orbit Display, 1 vs. 2, etc.
Spectrum/or Zoom	Narrowband real-time, baseband
	Average display, baseband or zoom
	Sync spectrum average display
Cross Spectrum	Magnitude
	Phase
	Real and Imaginary
Cross Properties	Transfer Function (any channel selectable as the reference).
	Magnitude
	Phase
	Coherence
	Real and Imaginary
	Nyquist
Math Operations	Differentiation and Integration
	Double differentiation and integration
	Sum
	Product
	Difference
	Ratio
	(all functions to be performed on like data from any two channels).

Averager

Domain	Time, frequency or amplitude on any or all channels.
Modes	Summation, Exponential, Peak and +1.
Ensembles	Selectable from 1 to 999 in integer steps.
Seconds	Selectable from 1 to 999 in one-second intervals.
Control	Start, Stop, Erase and Store (transfers averager contents to Store Memory).

DSP Operation

32 bit, 40 MHz floating point primary processor (20 million floating point operations per second)
16 bit secondary processor for each channel pair (20 million operations per second)

Display

Full VGA, 640 X 480 display lines (800 X 600 external)

Window	One to nine displays, user configurable size, aspect and location. User selectable grids and/or tics, linear and logarithmic. Unrestricted, fully user selectable display/channel combinations.
View Window	User defined full scale miniimum and maximum for both X and Y axes.
Real Time Clock	On-screen display of data and time to 1 second resolution. Annotation of time and stored records to 0.1 second resolution.
X-Axis Readouts	Hz, RPM, and Seconds
Y-Axis Readouts	Volts, EU, dB, dBV, dBR with modifiers of magnitude, magnitude squared, and magnitude squared/Hz. User defined labels for EU up to 5 characters. dBref calculated and displayed.
Y-Units Select	English or Metric
Cursors/Markers	Locked cursors for like displays, selectable. Harmonics, peaks above threshold, and user-defined marks computed and displayed.
Text Entry	User-defined text entry on any hard copy availble.

Data Storage

Stores input record, processed data, or front-panel setups limited only by available disk space. ASCII and binary formats utilized for internal data storage.

Third Party Software Support

Optional direct data exchange with SMS Star Modal and Star Acoustics software programs for complete modal analysis calculations and display.

Hard Copy

Compatible with a wide variety of printers/plotters supported by Microsoft Windows through the parallel printer port. Print entire screen, screen without controls, hot display with or without information list. Print to output device or save graphic file to disk.

Operating System

MS-DOS and Microsoft Windows, capable of running third-party software programs.

Outputs

Standard Ports	Mouse Port Parallel Printer Port External Keyboard VGA Monitor RS-232 Serial Port
Constant Current Power (ICP)	4 mA constant current, 24 Vdc maximum, selectable for each channel.

Physical Characteristics

Dimensions	17.25 in. W X 9 in. H X 13 in. D (43.8 cm W X 22.9 cm H X 33.0 cm D)
Weight	27 lbs. (typical) (12.3 kg)
Power	115/230 Vac, 50 -60 Hz, internally switchable

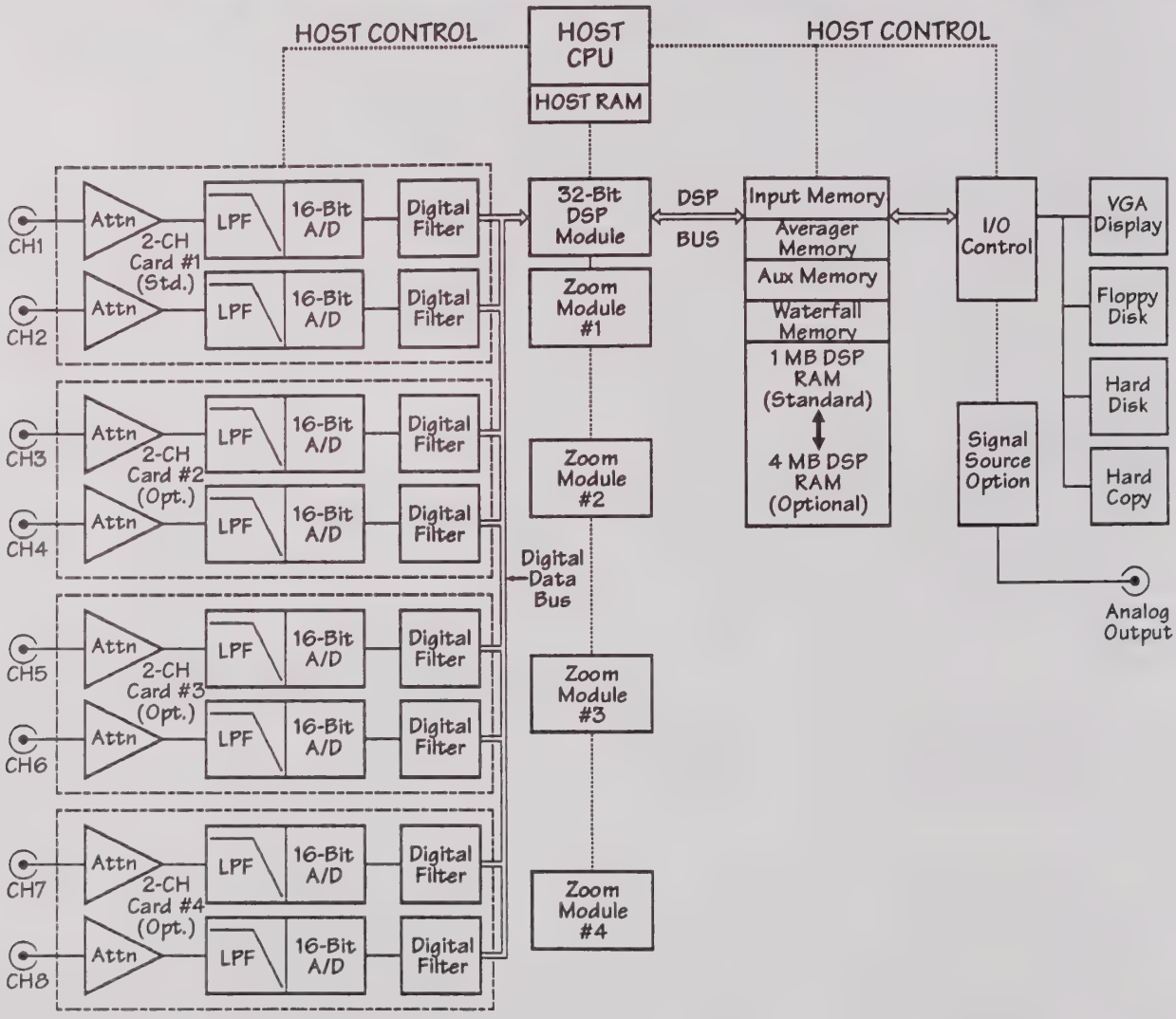
Environmental Characteristics

Temperature	+5° C to +45° C operating -10° C to +60° C non-operating
Humidity	90% non-condensing
Shock and Vibration	Operational, -2 g's, halfsine, 20 ms

General

Floppy Disk Drive	Built-in 3.5 inch microfloppy drive, standard 1.44 MB format MS-DOS.
Hard Disk Drive	Built-in 20 MB hard drive standard, option 40 or 120 MB.
Workstation CPU Memory	2 MB standard, 4 or 8 MB optional. With "-30" Option, 4 MB standard. With "-31" Option, 8 MB standard.

SD390 Basic Block Diagram



Section 2 - Initial Inspection & Safety Precautions

Introduction

This section contains instructions for performing an initial inspection of the Model SD390, general safety precautions, instructions on preparation for use, return shipment procedures including repacking instructions for return shipment and procedures for claiming warranty repairs.

Initial Inspection

Although the instrument is thoroughly inspected mechanically and electrically before packing for shipment, it must be inspected upon receipt for damage in transit.

SHOCKWATCH Monitors

If the shipping containers are equipped with SHOCKWATCH monitors, check the condition of the monitors before opening the containers. If the monitor indicates rough handling, follow the instructions on the SHOCKWATCH label.

Unpacking

Use care when removing the instrument from its shipping container to prevent damage to the front and rear-panel controls. Save the shipping container and all packing materials until the instrument has been thoroughly inspected for damage and checked for proper operation.

Equipment Furnished

Make sure that each item on the packing list is included with the shipment. Accessory kits may be shipped in separate containers.

Inspection for Physical Damage

Inspect all panels for dents, signs of chipped paint, or scratches. Check for broken or bent connectors, switches, and knobs. Photographs of damage may be helpful in substantiating subsequent claims.

Reshipment Procedure

If the instrument is to be reshipped after receipt, use of the original shipping container and packing materials is recommended. If original packing materials are not available, the following materials should be used:

- A double wall carton with a test strength of 350 pounds and of sufficient size to accommodate the required packing.
- Heavy paper or sheets of cardboard to protect all surfaces.
- Nonabrasive material such as polyurethane or cushioned paper between projecting parts and wall of carton.
- At least 4 inches of shock absorbent material such as extra firm polyurethane.

CAUTION

The use of flowable styrofoam packing materials (i.e., popcorn, peanuts, shells and spaghetti), is a leading cause of equipment damage during shipping. Any shipping damage resulting from the use of flowable packing material by the customer will be charged to the customer.

Returned Equipment With Warranty Or Damage Claims

If the equipment is found to be damaged in transit or does not operate as specified when received, notify the carrier and the nearest Scientific-Atlanta, Inc., Spectral Dynamics Products Customer Service office or representative by calling 1-800-426- 8887. The representative will arrange for repair or replacement of the system component.

Be sure to contact the Spectral Dynamics Products, Customer Service Department, at 1-800-426-8887 to obtain a Returned Material Authorization (RMA) Number prior to returning any equipment. Please attach a card to the component that shows the RMA Number, your company's name, address, person to contact, and telephone number. A short description of the damage or problem will also be helpful.

Safety Precautions

The SD390 presents no hazard to operating personnel if operated in accordance with the instructions contained in this manual. Read the following safety precautions before applying power to the system.

Explosion Hazards

Do not operate the SD390 in any area where flammable vapors are present. Operating any electrical device in such an environment may cause an explosion.

Electrical Shock Hazard

The SD390 is a Safety Class 1 device.

The three-conductor ac power line cord provided with the SD390 grounds the front panel and frame to prevent electrical shock and injury to operating personnel. The national and local electrical codes require three connector ac outlets that connect the third wire of the line cord to earth ground. If the ac outlets where the SD390 is to be operated are two wire type outlets, it will be necessary to:

- ➤ Install a three wire to two wire adapter at the ac outlet.
- ➤ Connect the adapter ground lead to ground before connecting the power cord to the outlet.
- ➤ Test for ground continuity between the equipment chassis and any adjacent equipment, or metal plumbing.

Preparation For Use

This section describes pre-operational equipment interconnection, cooling, and power requirements.

Equipment Interconnections

If the SD390 requires interconnection to customer furnished equipment, the initial interconnection, and any subsequent changes, should be performed by qualified personnel.

Power Requirements

The SD390 is designed to operate on either 115 Vac (standard) or 230 Vac (optional) line power. The line power circuit should be rated at 15 Amps or more. Before applying power to the instrument, make sure the fuse in the fuse-holder is a 2 Amp Slo-Blo.

Wiring Requirements

The SD390 is provided with a 15 Amp power cord (12 gauge wire).

SYMBOL	SYMBOL DEFINITION
IEC417, SYMBOL 5019	PROTECTIVE GROUNDING Terminal: A terminal which must be connected to earth ground prior to making any other connections to the equipment.
IEC417, SYMBOL 5032	A terminal to which or from which an alternating (sinewave) current or voltage may be applied or supplied.
IEC417, SYMBOL 5031	A terminal to which or from which a direct current or voltage may be applied or supplied.
IEC417, SYMBOL 5033	A terminal to which or from which an alternating and direct current or voltage may be applied or supplied.
IEC417, SYMBOL	EXPLANATION: This marking indicated that the operator must refer to an explanation in the operating instructions.
IEC417, SYMBOL 5036	HIGH VOLTAGE TERMINAL: A terminal at which a voltage, with respect to another terminal or part exists or may be adjusted to 1000 V or more.

NOTES

SAFETY SUMMARY

SD390 DYNAMIC SIGNAL ANALYZER

GENERAL

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this manual. It is the user's responsibility to understand and apply these safety precautions during all phases of operation, service, and repair of this system. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture,and intended use of this system.

GROUND THE SYSTEM

To minimize shock hazard, system chassis and equipment cabinet must be connected to an electrical ground. The SD390 is equipped with a three-conductor AC power cable. This power cable must be installed in accordance with installation procedures provided.

CAUTION

Display power supply fuse to be replaced with on the following ratings: 250V, T3/4 amp., slow-blow.

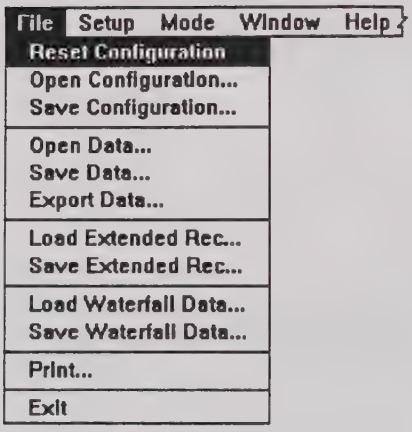
Section 3 - Main Menus

Overview

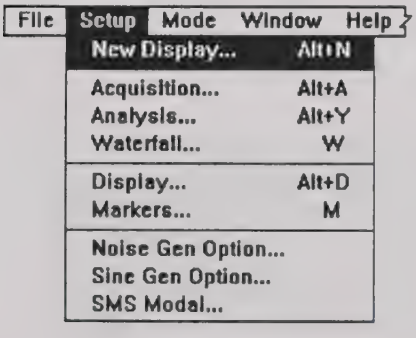
File Setup Mode Window Help

Five Main Menu items displayed at on the top Menu band allow accessing all the features and functions of the SD390.

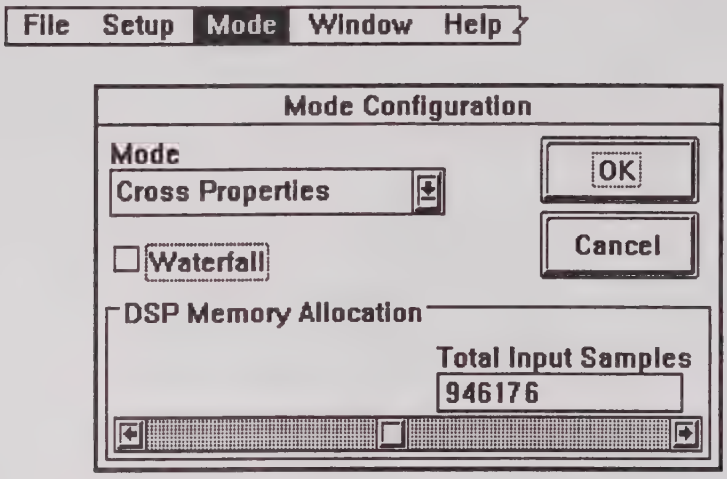
➤ The **File Menu** contains functions to Save and Restore System Configurations, to Save, Restore, and Export Data and to display data on hard copy devices.



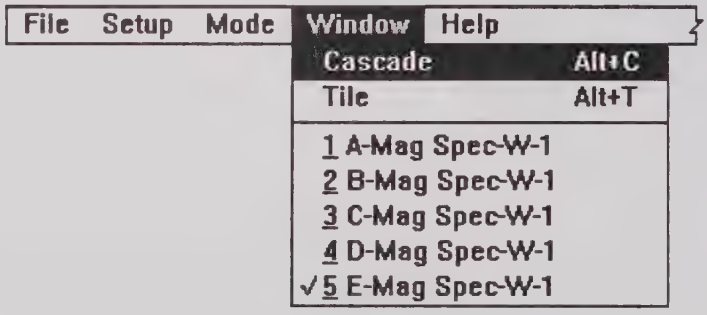
➤ The **Setup Menu** accesses Dialogs to Create, and Modify Acquisition, Analysis and Display parameters.



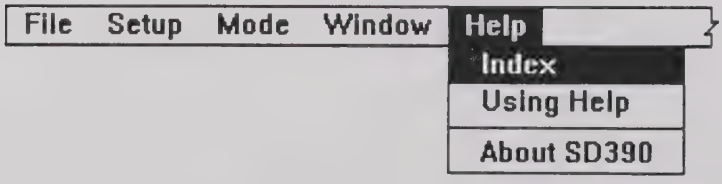
➤ The **Mode Menu** sets the data collection and analysis mode of the analyzer.



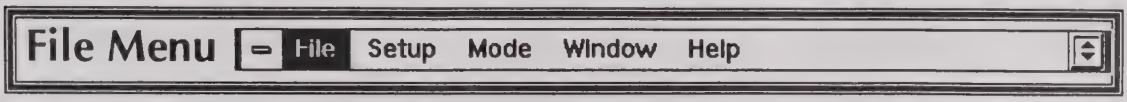
➤ The **Window Menu** allows arranging Display Windows in the SD390 viewing area.



➤ The **Help Menu** Includes on-line documentation and configuration information.

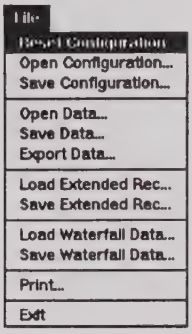


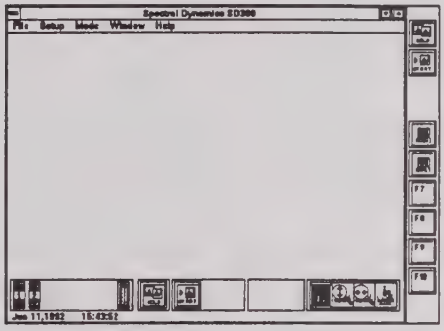
File Menu



Reset Configuration

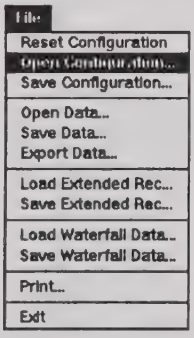
Restores all menu settings in the SD390 to the factory defined default configuration and clears the display.

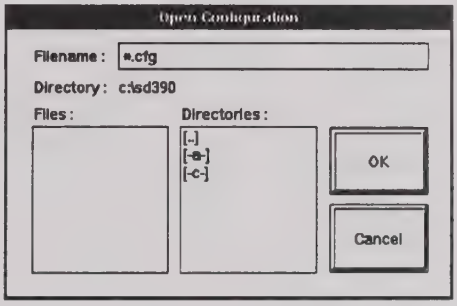




Typical Factory Default Configuration

Open Configuration





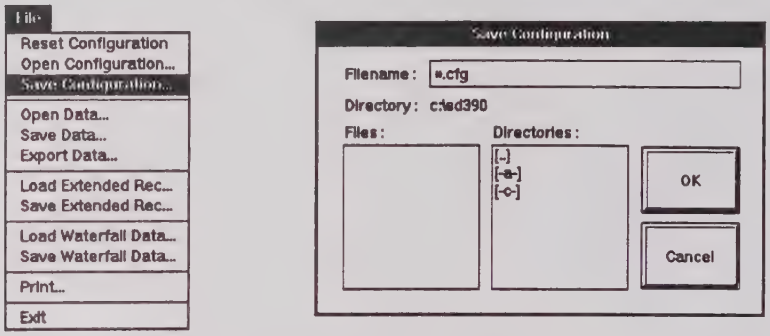
Restores the configuration of the SD390 to a defined configuration that was created when the **Save Configuration** command was issued. The configuration includes:

- Settings for the **Acquisition Setup** Dialog.
- Settings for the **Analysis Setup** Dialog.
- Settings for the **Waterfall Setup** Dialog.
- All preconfigured **Display Windows.**

If no setup has previously been saved, this command has no effect.

☞ *The Open Configuration Dialog is used to select a particular configuration file from a selected directory and storage device.*

Save Configuration

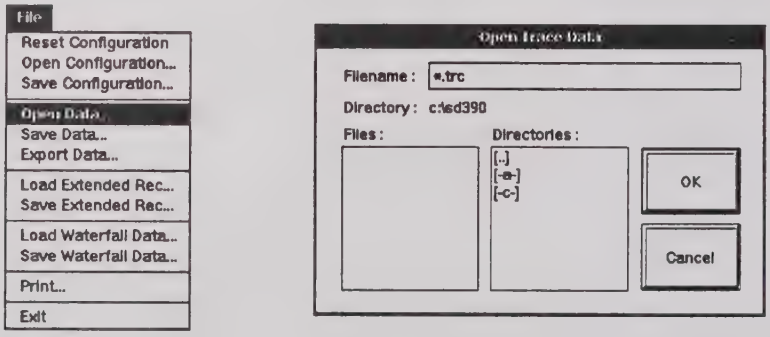


Saves the current configuration of the SD390 to a named Configuration File for subsequent recall by the **Open Configuration** command. The configuration includes:

- ➤ Current settings for the **Acquisition Setup** Dialog.
- ➤ Current settings for the **Analysis Setup** Dialog.
- ➤ Current settings for the **Waterfall Setup** Dialog.
- ➤ All current **Display Windows**.

☞ *The Save Configuration Dialog is used to specify a particular configuration file that will be saved on selected directories of the permanent storage devices. The default directory and storage device is the current directory,* **C:\SD390**.

Open Data

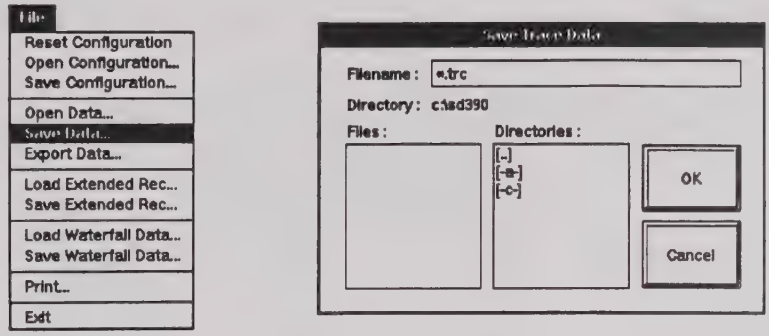


Opens a specified Data Trace File (**.TRC**) for recall and display. The Trace File is read from disk and the data is displayed in a new Display Window, provided that a new display window can be created. The Display parameters are those that were active when the data was saved (see above), although the x and y axis scales are initially set to the default values of the display.

The name of the data file is selected by using the **Open Data** Dialog.

☞ *If the maximum number of Windows are already displayed on the screen, this function will not be processed.*

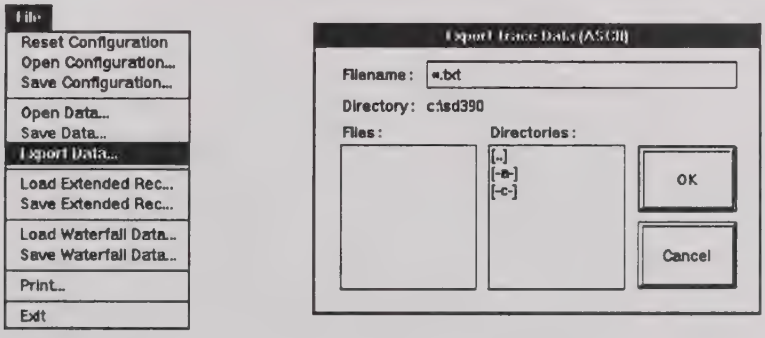
Save Data



Saves the data and Display Configuration for the specified Display Window to a named Data Trace File (**.TRC**) for subsequent recall and display. The Display Window is selected by moving the arrow cursor to the title bar of the desired Window, and clicking the selector button. The Save Data Dialog will then allow you to name the file.

☞ *Compressed Time Displays cannot be Saved. See Load Extended Rec in this section.*

Export Data

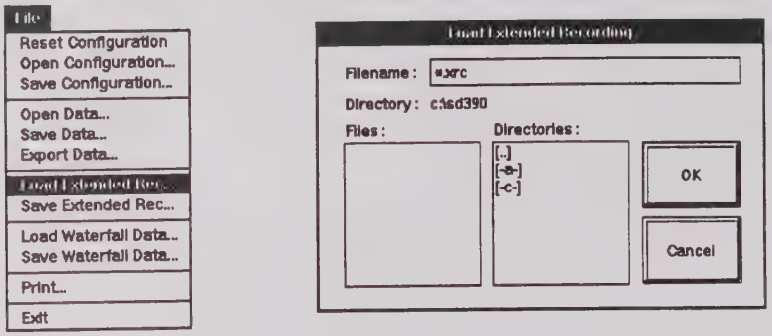


Displayed data can be exported to other programs or other systems by using the Export Data function. The desired data is selected by moving the arrow cursor to the Title Bar of the desired Display Window, and clicking the selector button.

The **Export Data** Dialog will then allow you to name a file where the data will be placed. The data is stored on a disk file in ASCII format, in the displayed UNITS. The format of the Export Files is described in this Manual.

☞ *Compressed Time Displays cannot be Exported. The default directory and storage device is the current directory, C:\SD390.*

Load Extended Rec



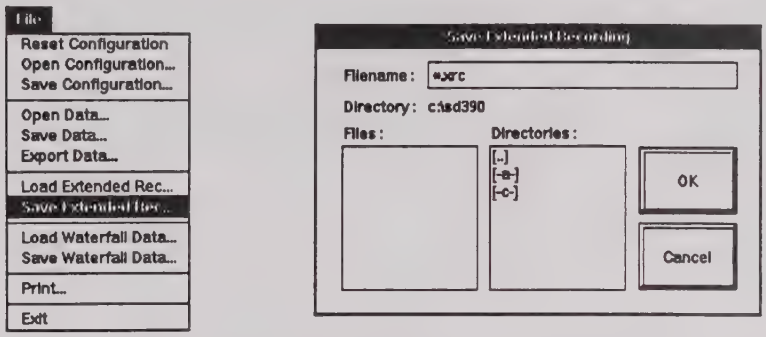
Data from the SD390's Extended Recorded Memory that has been previously saved to a named disk file is retrieved and loaded into Extended Recorder Memory. The Acquisition and Analysis Parameters that were in effect when the data was saved are also restored.

When **Load Extended Rec** is selected, Acquisition (and Averaging) if active, is stopped. The **Load Extended Rec** Dialog will then allow you to name the file from which to retrieve the data.

It is recommended that the **.cfg** file that was manually saved when the corresponding **.xrc** file was saved, be recalled *prior* to recalling the **.xrc** file. This will ensure proper analyzer display setup for the recalled **.xrc** file (see the NOTE under **Save Extended Rec**).

Data from an Extended Rec disk file can be loaded at any time. However, all current data, Acquisition and Analysis Parameters are replaced by the saved data and saved parameters. These parameters may not be compatible with the current settings, and may invalidate the current Averager and Displays. Therefore, it's good practice to stop Acquisition before Loading this data, although this function will automatically stop Acquisition (and Averaging) if active. Parameters that were in effect when the data was saved are also loaded at this time.

Save Extended Rec



Data in the SD390's Extended Record Memory can be saved to a named disk file for subsequent playback and analysis. The entire contents of the Extended Record Memory (time domain data) for all active channels is saved.

The Extended Record Memory can be saved at any time. It is good practice to stop Acquisition before Saving this data, although this function will automatically stop acquisition (and Averaging) if active.

The Save XRec Dialog will then allow you to name a file where the data will be placed. The data is stored on a disk file in binary format.

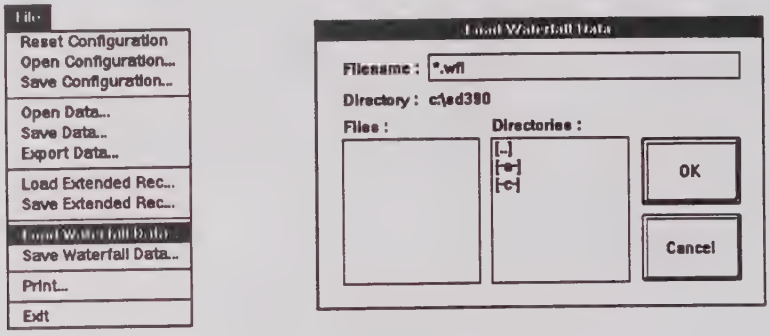
To streamline the recall of saved **.xrc** files, it is strongly recommended that a configuration file be saved along with the **Save Extended Rec** data file. Use the same file name with **.cfg** appended under the Save Configuration File.

Because **Save Extended Rec** is a global command that affects more than the "hot" compressed trace window, you should recall the **.cfg** file before recalling the **Load .xrc** file to ensure proper analyzer display setup for the recalled **.xrc** file.

☞ *Extended Recorder Data cannot be Exported.*

☞ *The default directory and storage device is the current directory, C:\SD390.*

Load Waterfall Data



Data from the SD390's Waterfall Memory that has been previously saved to a named disk file is retrieved and loaded into the Waterfall Memory. The Acquisition and Analysis Parameters that were in effect when the data was saved are also restored.

When Load Waterfall is selected, the Analyzer is first put into HOLD. The Load Waterfall Dialog will then allow you to name the file from which to retrieve the data.

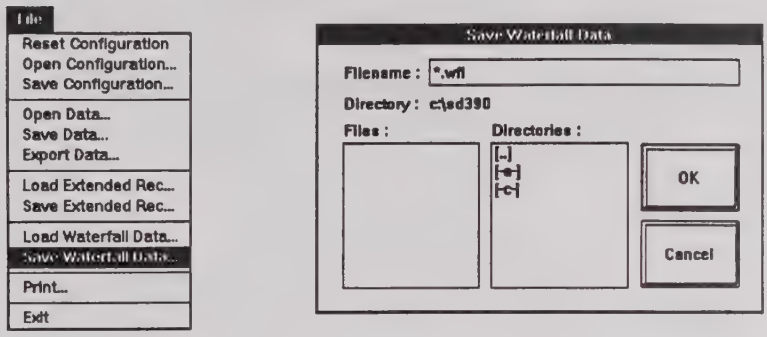
It is recommended that the **.cfg** file that was manually saved when the corresponding **.wfl** file was saved, be recalled *prior* to recalling the **.wfl** file. This will ensure proper analyzer display setup for the recalled **.wfl** file (see the NOTE under **Save Waterfall Data**).

Data from a Waterfall data disk file can be loaded at any time. However, all current data and Acquisition and Analysis Parameters are replaced by the saved data and saved parameters. These parameters may not be compatible with the current settings, and may invalidate the current Averager, and/or Waterfall Memory and associated displays. Therefore, it's good practice to stop Acquisition before Loading this data, although this function will automatically stop all acquisition functions if active.

☞ *Waterfall Data cannot be Exported.*

☞ *The default directory and storage device is the current directory, C:\SD390.*

Save Waterfall Data



Data in the SD390's Waterfall Memory can be saved to a named disk file for subsequent playback and analysis. The entire contents of the Waterfall Memory (selected waterfall analysis function) for all active waterfall channels is saved.

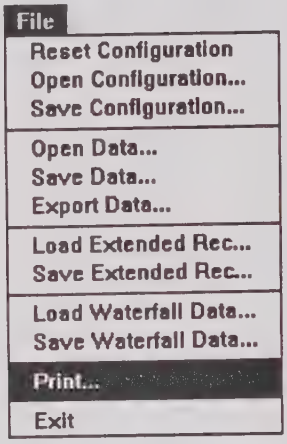
The Waterfall Memory can be saved at any time. It's good practice to stop Acquisition before Saving this data, although this function will automatically stop all acquisition functions if active.

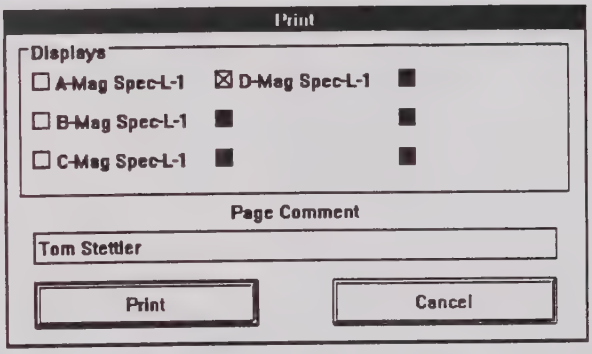
The Save Waterfall Dialog will then allow you to name a file where the data will be placed. The data is stored on a disk file in binary format.

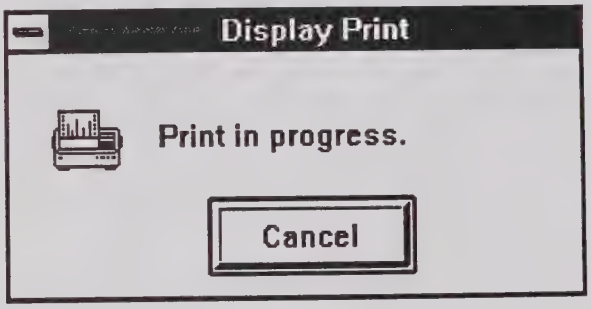
To streamline the recall of saved **.wfl** files, it is strongly recommended that a configuration file be saved along with the **Save Waterfall Data** file. Use the same file name with **.cfg** appended under the Save Configuration File.

Because **Save Waterfall Data** is a global command that affects more than the "hot" compressed trace window, you should recall the **.cfg** file before recalling the **.wfl** file to ensure proper analyzer display setup for the recalled **.wfl** file.

Print

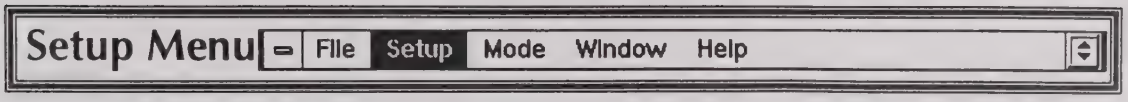






Prints a copy of the SD390 screen to attached printer or other hard copy device.

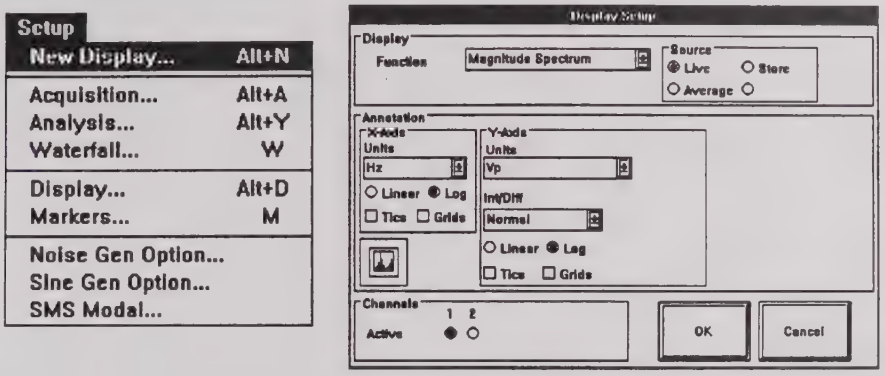
You can cancel printing while the Print Dialog is visible by pushing the dialog's "Cancel" button. It takes a few seconds before the printing job is canceled. For more information on Printing see More on hard copy.



The following parameters can be set, modified and examined by selecting the appropriate topic from the Setup Menu.

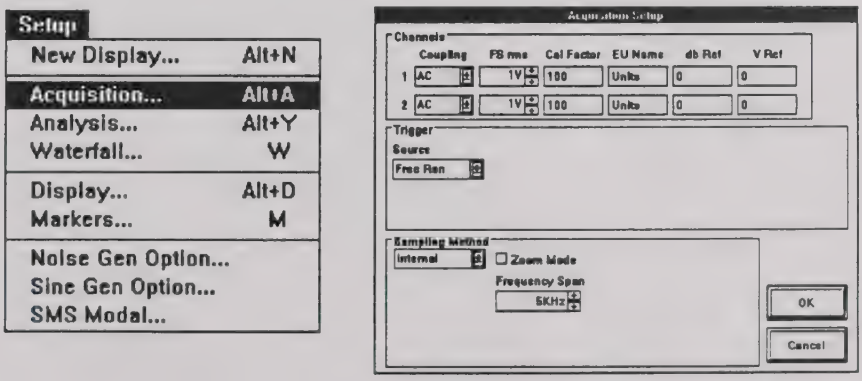
New Display

Invokes the **Display Setup** Dialog to specify the settings for a new display.



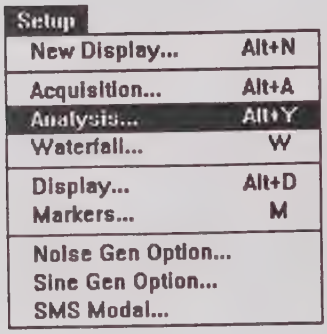
Acquisition

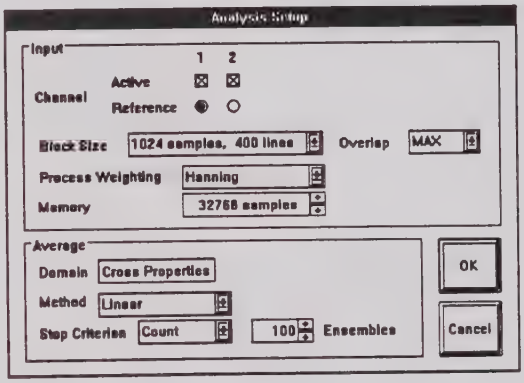
Invokes the **Acquisition Setup** Dialog to change the SD390 data acquisition parameters.



Analysis

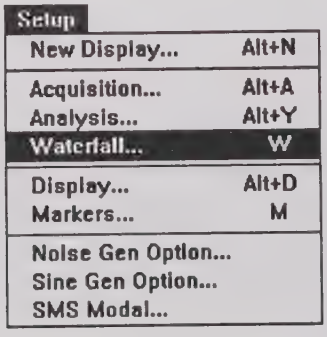
Invokes the **Analysis Setup** Dialog to change the SD390 analysis parameters.

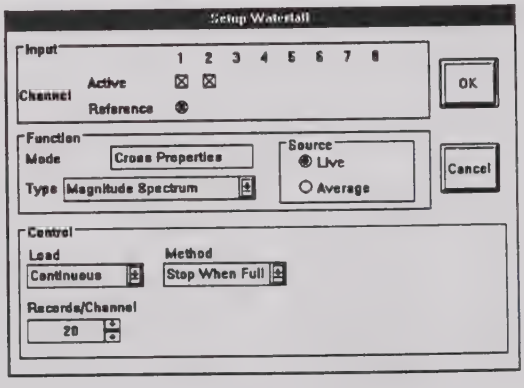




Waterfall

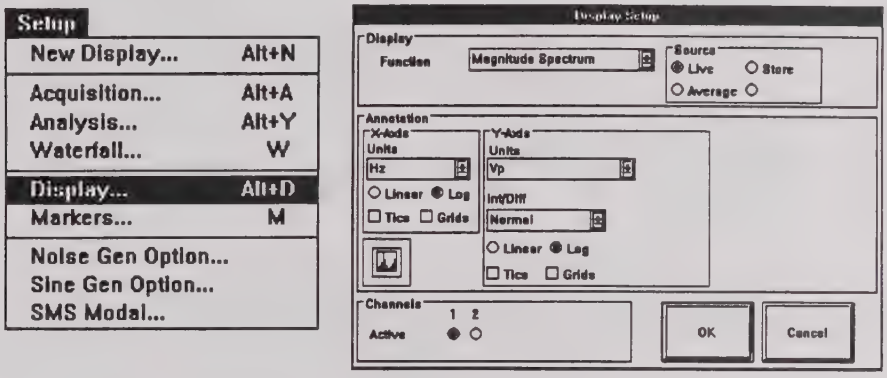
Invokes the **Setup Waterfall** Dialog to configure the SD390 waterfall analysis parameters.





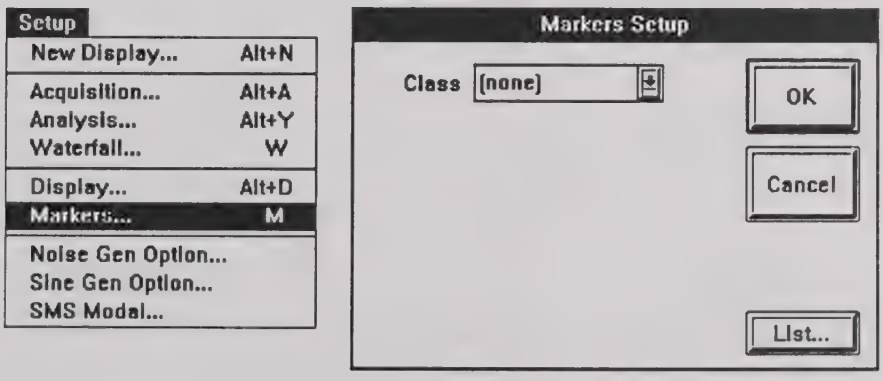
Display

Invokes the **Display Setup** Dialog to modify the settings of the currently active display.



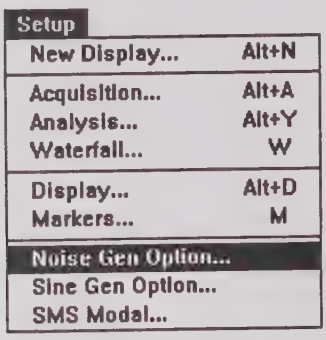
Markers

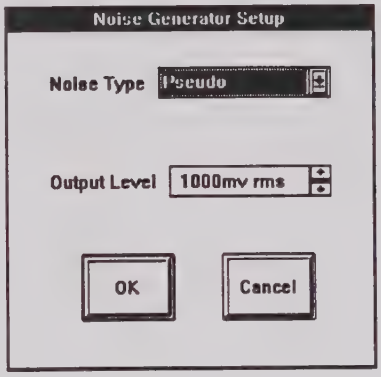
Invokes the **Marker Setup** Dialog to select and list markers for a specified trace.



Noise Gen (Option)

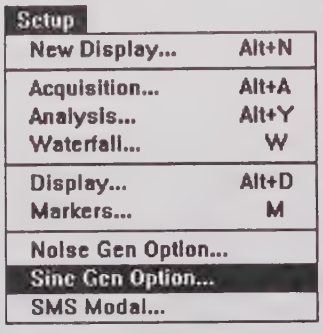
Invokes the **Noise Generator Setup** Dialog to set parameters for a random signal source output, and to initialize signal output.

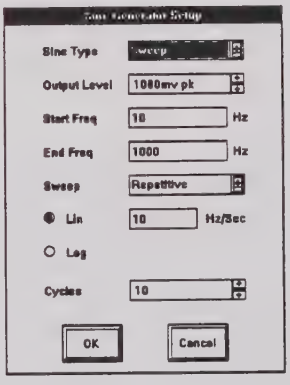




Sine Gen (Option)

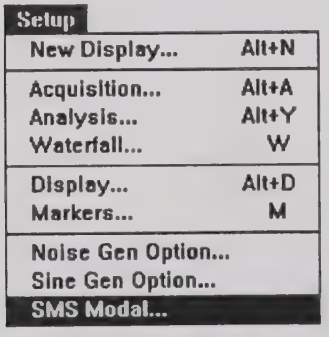
Invokes the **Sine Generator Setup** Dialog to set parameters for a swept or dwell sine signal output, and to initialize signal output.

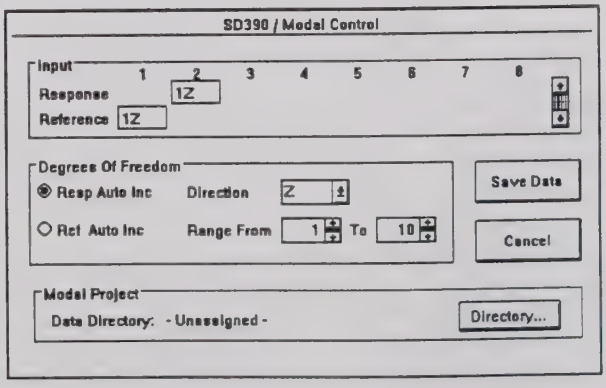




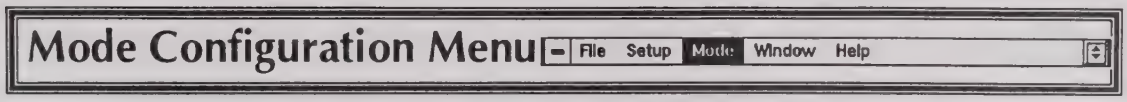
SMS Modal (Option)

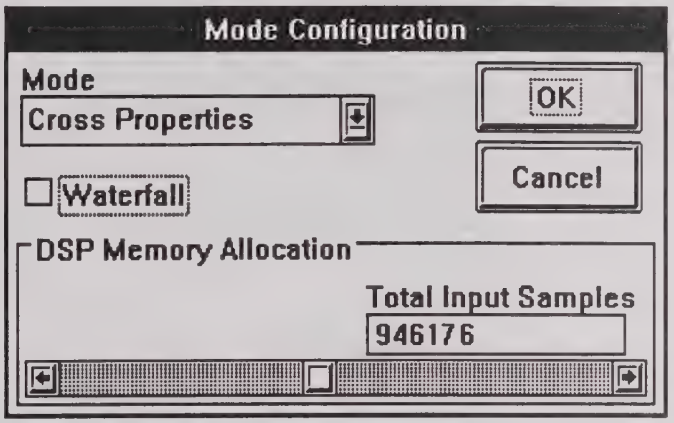
Invokes the SMS Modal Interface Setup Dialog to specify parameters and initiate saving FRF data in SMS Modal format.





Mode Configuration Menu





The Mode Configuration Menu controls the "personality" of the analyzer. Selecting the appropriate Mode Configuration will affect the types of analyses and displays that can be produced, and determines the resource utilization of the SD390. Careful selection of the Mode Configuration will allow a balance between required analysis functions and optimal real time rates.

How To Invoke

To invoke the Mode Configuration Dialog:

➤ **Use the trackball to:**

Select **Mode** from the main menu

or

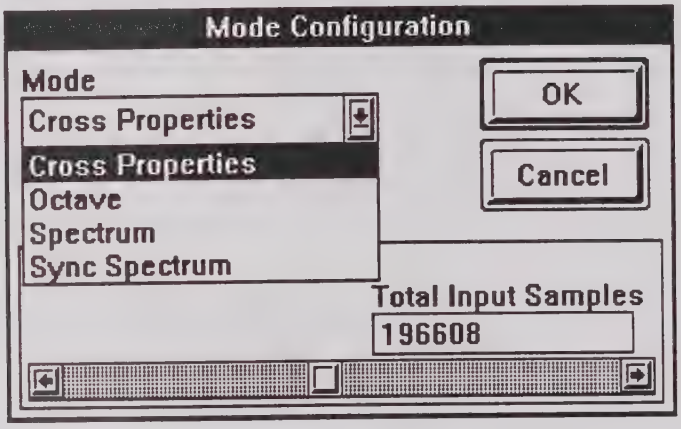
➤ **Use the keyboard and:**

Hold down the **ALT** key and press the **"M"** key

Analyzer Mode parameters are not set until the "OK" button at the upper right corner of the dialog is pressed. Selecting "Cancel" causes the dialog to disappear without affecting the mode parameters.

Mode

The list of available modes appear in the pull down Mode combo box. You may select the desired mode by highlighting and clicking on the appropriate Mode item.



The three *standard* Mode selections are:

Cross Properties

This is the default mode which results in the most versatile use of the SD390 in spectrum mode, in that power spectrum and cross property data (transfer functions, cross spectrum, etc.) is available, and almost all analyses and displays (except for sync spectra) are available.

Spectrum

This mode is used when only Time and Power Spectral data is required. It conserves internal resources, and allows very high real time rates for Live and Averaged spectral processing.

Sync Spectrum

This mode is used when Time Synchronized averaging is required. This mode must be enabled for synchronous spectrum displays as it enables Time averaging.

☞ *If the Octave Analysis Option is installed, the* ***Octave Mode*** *selection also appears.*

Octave

This mode enables Octave analysis in place of Spectrum analysis. Discrete digital filters are used to compute the amplitude levels of the selected bands.

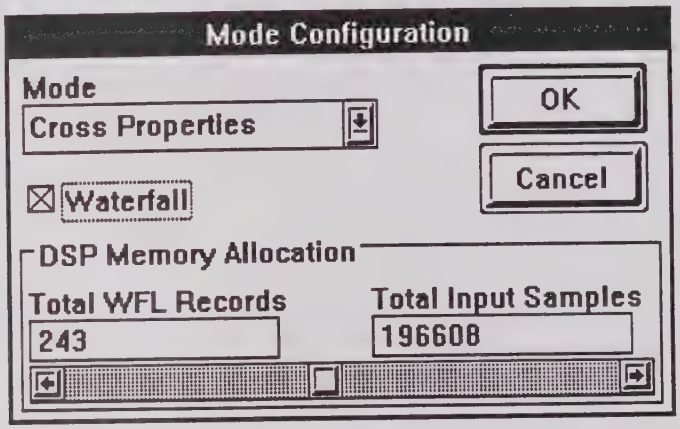
The Analysis Mode also will automatically select the Averager Domain which determines the types of analyses and displays that can be produced. See data sources in the Display Dialogs for more information.

The availability of certain trace displays is affected by the current mode. The factory default Mode is set for Cross Spectrum. See the table in the description of the Display Setup Dialog's display type control.

The Real Time Rate of the SD390 is controlled by careful selection of the Analysis Mode. For the fastest Real Time Spectrum analysis rates, set the Domain to Spectrum. Of course, the prime determinant of the Domain setting is the type of analysis required.

Waterfall Mode Enable Check Box

This check box enables or disables Waterfall Mode. When enabled, data can be processed and loaded into the Waterfall Memory and recalled (or played back) from the Waterfall Memory.



DSP Memory Allocation

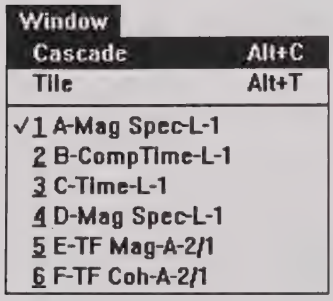
The amount of available analyzer memory can be divided between Extended Recorder Memory and Waterfall Memory when the Waterfall mode is enabled. This control proportions the maximum amount of available memory between Extended Recorder use and Waterfall use. The desired amount of memory per channel (up to the maximum allocated from this control) for the Extended Record is set on the Analysis Setup Dialog, and the amount for Waterfall is set on the Waterfall Setup Dialog.

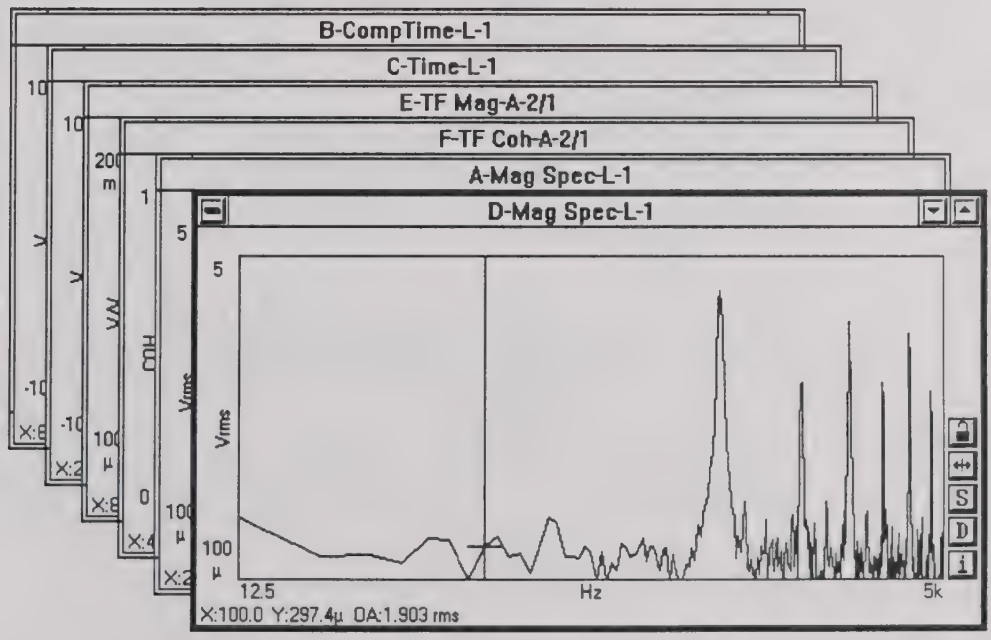
The total amount of memory is shown in TOTAL samples available for Extended Memory and the TOTAL records (at the current Block Size) for Waterfall Memory.

The Analysis and Waterfall Setup Dialogs allow selection of these parameters in samples per channel or records per channel.

Cascade

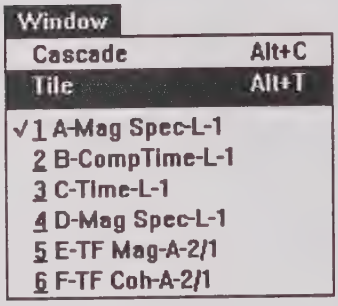
Organizes the Display Windows so that they "stack up" one atop another but with the title bar and left hand edge of each display window being visible as shown.

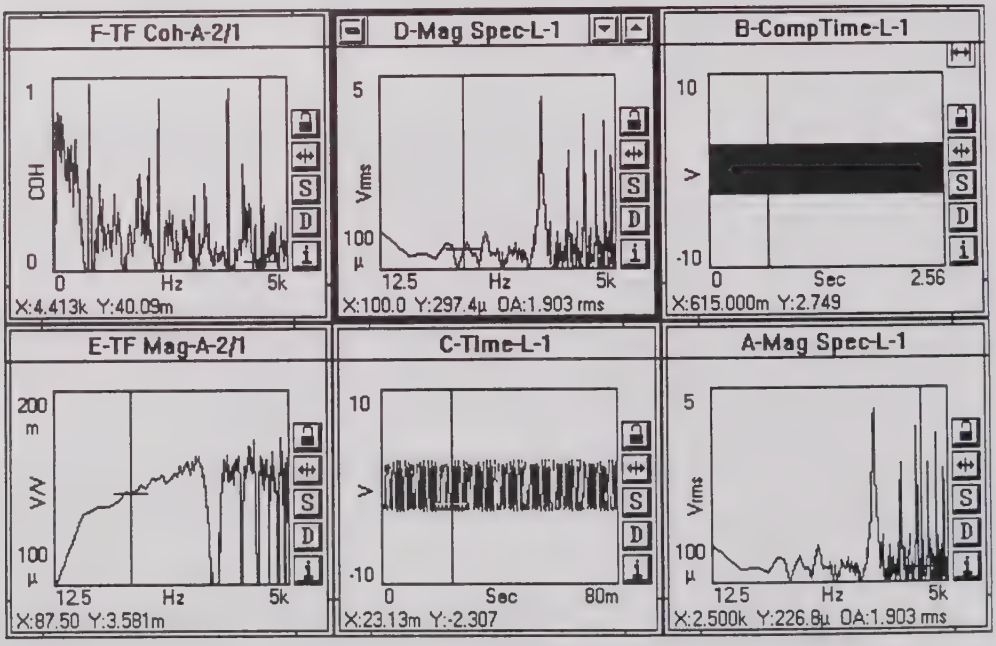




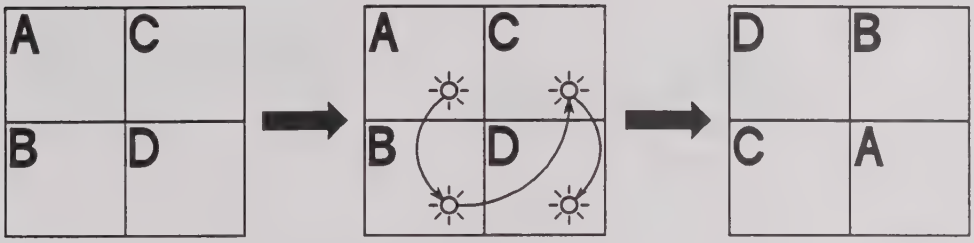
Tile

Tiles all Display Windows within the frame window by moving and resizing them so that no Display Windows overlap one another and all area within the frame window is used as shown in the following example.



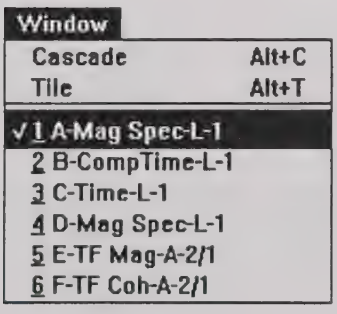


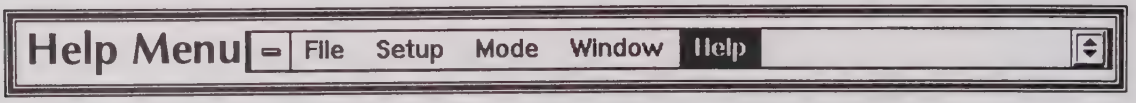
Display windows are tiled in the opposite order in which they are made active (a Display Window is made active by clicking anywhere on it). The following diagram illustrates this process.



Display Window List

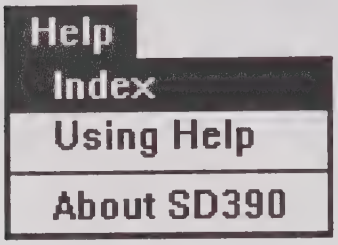
A list of all Display Windows also appears at the bottom of the Window menu, separated from the other items by a solid black line. Clicking on one of the titles will make the corresponding Display Window the active Display Window and make it visible if it is hidden or iconized.

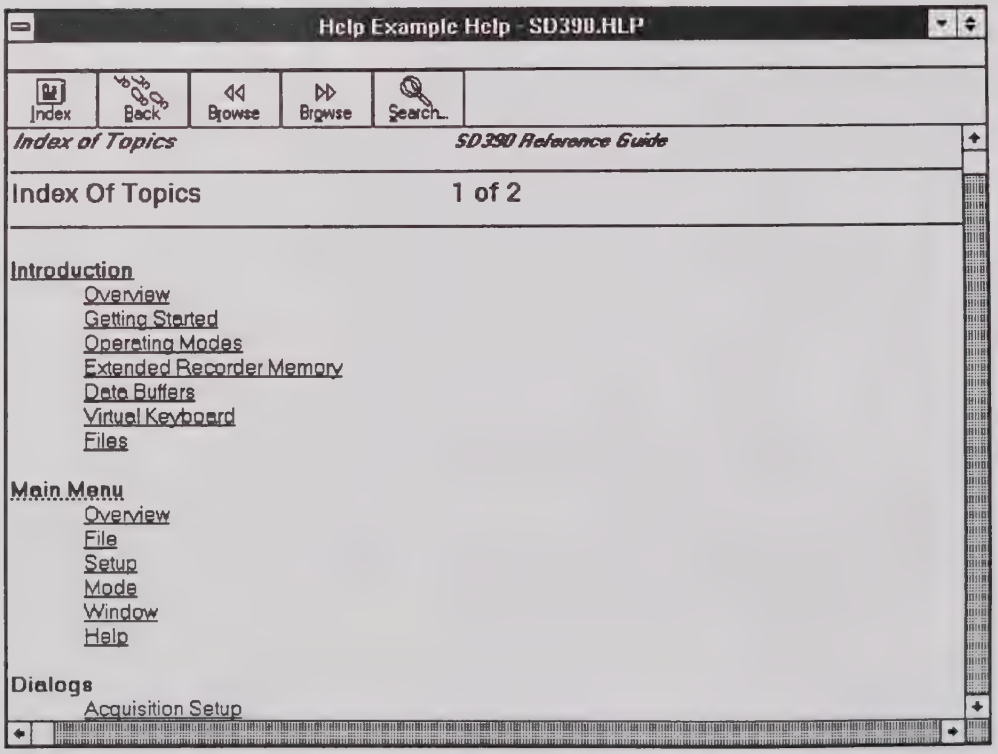




Index

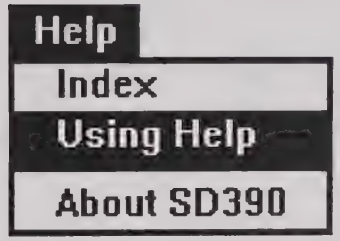
Invokes the SD390 on-line manual, beginning at the main index.





Help

Invokes the Microsoft Windows help system user's manual. Use this if you have any questions about the help system.

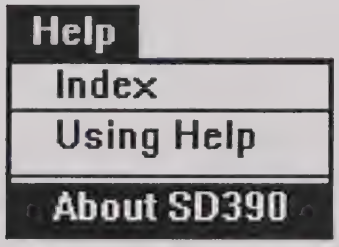


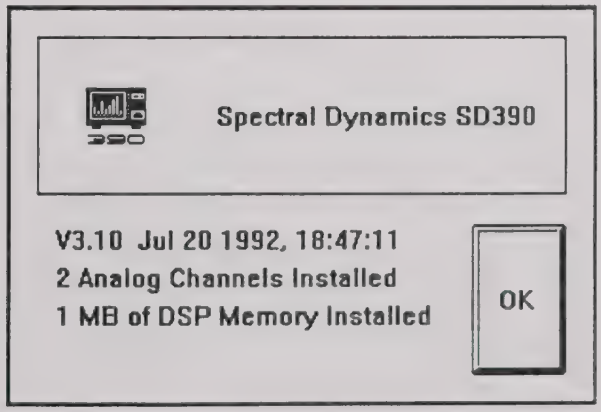
About SD390

The About SD390 Dialog displays the hardware characteristics of the SD390 plus the Application System Version number, as well as the date and time the application version was created.

If there is any question as to the configuration of your particular SD390, refer to this dialog. This dialog can also provide useful diagnostic information concerning the operation of the hardware, and can indicate possible incompatibilities when transferring files from one machine to another.

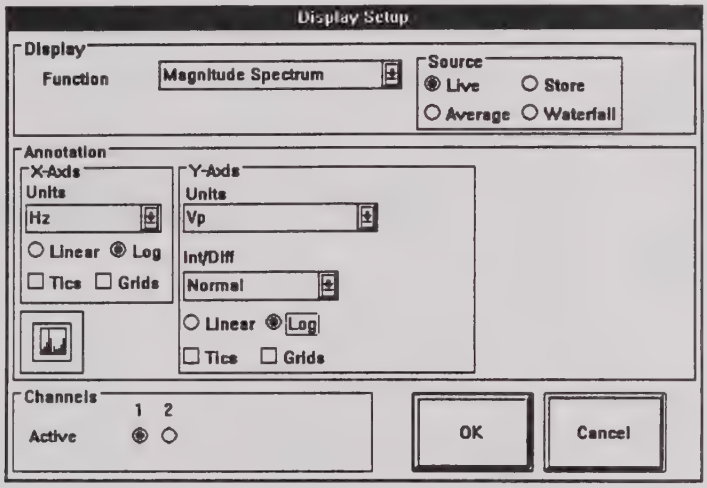
When finished, click on the "OK" button at the bottom right corner of the dialog.





NOTES

Display Setup



The Display Setup Dialog is used to initialize a new display or modify the existing display parameters for an SD390 Display Window. These parameters include:

- **Display Function**
- **Display Source**
- **X- and Y-axis Units**
- **X- and Y-axis Scaling**
- **Channel(s) to be Displayed**

Display parameters, as opposed to acquisition and analysis parameters, are local to the Display Window. Creating a display or changing the parameters of a display has no effect on other displays or on the global SD390 parameters.

The SD390 allows up to 9 Display Windows. After 9 displays have been created, you cannot create more without first disposing of some of the existing Display Windows as described in the Display Area section of this manual.

How To Invoke

The Display Setup Dialog is used both for creating new displays and for modifying existing displays.

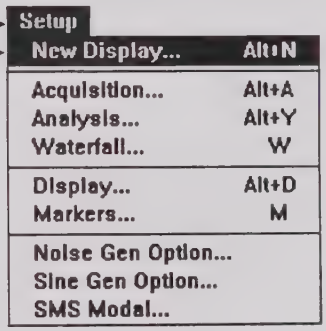
New Display

To invoke the Display Setup Dialog to create a new display:

➤ **Use the trackball to:**

Select the **Setup** menu

Select **New Display**



➤ **Or use the keyboard and:**

Hold down the **ALT** key and press the **N** key.

A new dialog is not created until the **OK** button at the bottom right corner of the dialog is pressed. Selecting **Cancel** causes the dialog to disappear without creating a new Display Window.

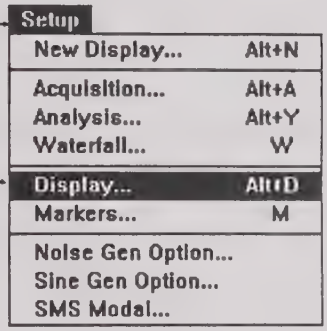
Existing Display

To invoke the Display Setup Dialog to modify an existing display, first make the display the active display (if it is not already) by clicking anywhere on the desired Display Window, then:

➤ **Use the trackball to:**

Select the **Setup** menu

Select **Display**



➤ **Or use the keyboard and:**

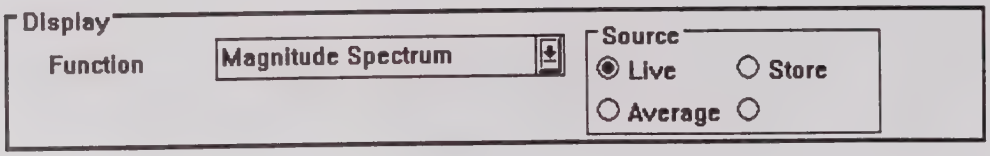
Hold down the **ALT** key and press the **D** key.

or

Select **D** in the Active Trace Window

The display parameters for the active display are not changed until the **OK** button at the bottom right corner of the **Display Setup** dialog has been pressed. Selecting **Cancel** causes the dialog to disappear without affecting the display parameters for the active display.

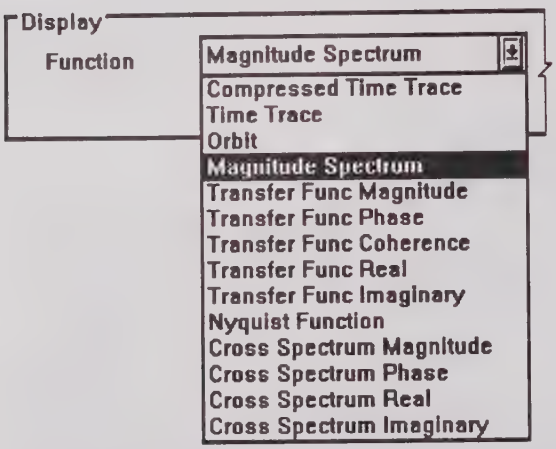
Display Group



The display group is used to set up the function and data source for SD390 displays.

There can be up to 9 displays simultaneously, with each display showing its own type of trace (e.g. time, spectrum, transfer function). Data for the trace may be either live, from the averager, from store memory, or from a trace stored on a disk file.

Function



The function combo box allows you to select which type of trace is to be displayed from data that is currently in the SD390 memory. Only valid display functions are listed, and these vary depending on the following factors:

➤ **Averager Domain**

As specified in the Average group of the Analysis Setup Dialog.

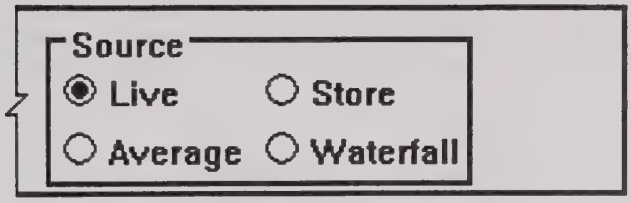
➤ **Store Contents**

As determined by the current status of store memory (empty or not).

➤ **Mode Configuration**

As determined by the current status of the Mode Configuration dialog.

Source



The source radio button group is used to determine whether the trace data is live, will come from the averager, or will come from the storage memory. If a particular source is invalid for the selected display function, the corresponding radio button will be grayed out.

If the trace is from a recalled Trace File, the source will only show the source from where the data originated. It cannot be changed.

The following table shows the relationship between the display function, display source, and analysis mode. For any given display function, the allowable display sources (L for Live, A for average, and S for Store) are given according to the analysis mode set in the Mode Menu. Entries that are empty (have neither an L, A, or S in them) indicate that the display function is not available for the given average domain.

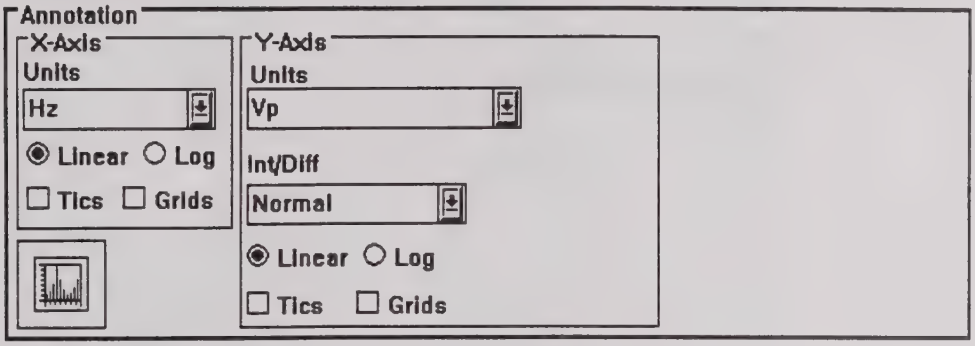
Display Function	Analysis Mode			
	Sync Spectrum	Spectrum	Cross Spectrum	Octave (Option)
Time Trace	L A S	L	L	
Compressed Time	L	L	L	
Orbit	L A S	L	L	
Magnitude Spectrum	L A S	L A S	L A S	
Transfer Func Magnitude			A S	
Transfer Func Phase			A S	
Transfer Func Coherence			A S	
Transfer Func Real			A S	
Transfer Func Imaginary			A S	
Nyquist Function			A S	
Cross Spectrum Magnitude			A S	
Cross Spectrum Phase			A S	
Octave (option)				L A S

☞ *For Orbit traces, the X axis is the "reference" channel and the Y axis is the "active" channel.*
For Nyquist traces, the X axis is the real component and the Y axis is the imaginary component.
Octave Traces also display the Overall Level as an additional bar to the right of the main trace.

SD390 Hint

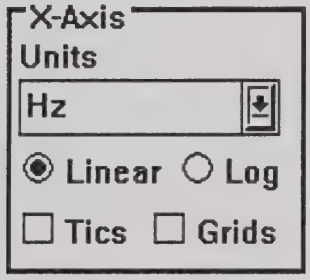
Only valid display functions are shown as dialog choices. However, when changing Analysis Modes, the currently selected displays may not be valid with the new Mode for Live and Averager displays, but STORE may still contain valid data from the previous mode. Be sure to check that the function *and* Source of the display agree with the new mode. If not, change the source first.

Annotation Group



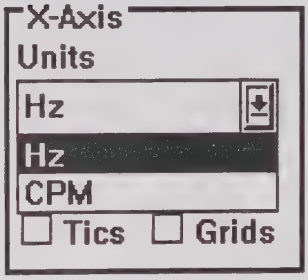
The annotation dialog is used for x and y-axis annotation, x and y-axis scaling, enabling/disabling grid and tic marks and, for Magnitude Spectrum integration and differentiation.

X Axis Controls



The x-axis controls are used to control the annotation and scaling of the display x-axis.

Units (X-Axis)

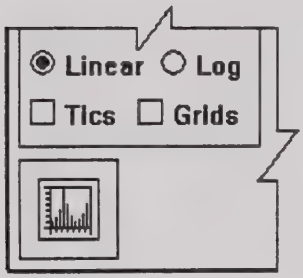


The units combo box allows you to select which units will be used on the x-axis of the display. These units depend upon the display function and the axis scaling. The following table shows which units are available for the x-axis based on display function for axis scaling (blank entries denote invalid combinations of display function and scaling):

Display Function	Linear	Log
Compressed Time	Seconds	
Time Trace	Seconds	
Orbit	V, EU	
Magnitude Spectrum	Hz, CPM*	Hz, CPM*
Transfer Func Magnitude	Hz, CPM	Hz,CPM
Transfer Func Phase	Hz, CPM	Hz, CPM
Transfer Func Coherence	Hz, CPM,	Hz, CPM
Transfer Func Real	Hz, CPM	Hz, CPM
Transfer Func Imaginary	Hz, CPM,	Hz,CPM
Nyquist Function	V/V, EU/EU	V/V, EU/EU
Cross Spectrum Magnitude	Hz, CPM	Hz, CPM
Cross Spectrum Phase	Hz, CPM	Hz, CPM
Cross Spectrum Real	Hz, CPM	Hz, CPM
Cross Spectrum Imaginary	Hz, CPM	Hz, CPM
Octave Spectrum (Option)	Hz (logarithmically distributed by band)	

*Orders if SRA option is installed

Scaling (X-Axis)

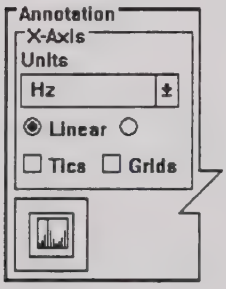


The scaling radio buttons determine the scale for the axis, linear or logarithmic (base 10). If one of the scaling functions is invalid for the selected display type, the scaling defaults to the valid scaling function and the control corresponding to the invalid scaling function is grayed.

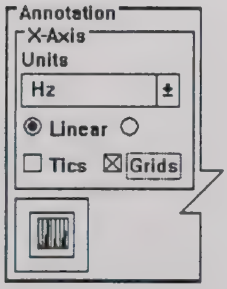
Grids and Tic Marks (X-Axis)

Grids and Tic Marks for this axis can be independently selected by choosing the desired options as follows:

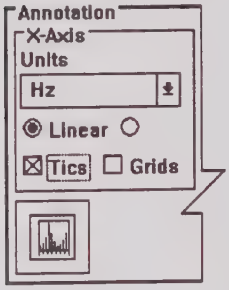
Open - no grids or tic marks; deselect both grid and tic options.



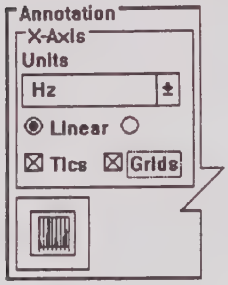
Grids Only - select the grid option.



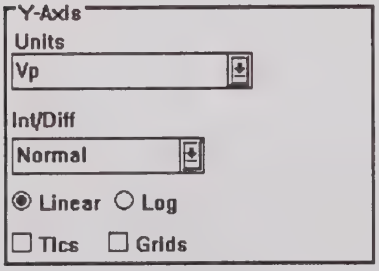
Tics Only - select the tics option.



Grids and Tics - select both the grid and tic options.

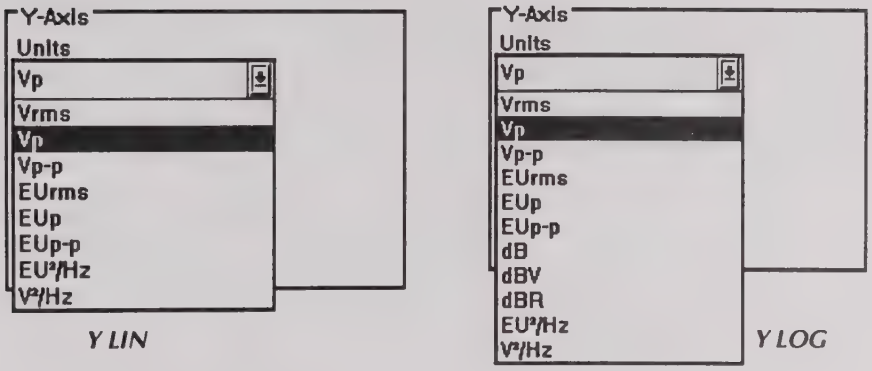


Y Axis Controls



The y-axis controls are used to control the annotation and scaling of the display y-axis.

Units (Y-Axis)



The units combo box allows you to select which units will be used on the y-axis of the display. These units depend upon the display function and the axis scaling. The following tables show which units are available for the y-axis based on display function and axis scaling (blank entries denote invalid combinations of display function and scaling):

Display Function	Linear
Time Trace	V, EU
Compressed Time	V, EU
Orbit	V, EU
Magnitude Spectrum	Vrms, Vp, Vp-p, EUrms, EUp, EUp-p, V^2/Hz, EU^2/Hz
Transfer Func Magnitude	V/V, EU/EU
Transfer Func Phase	-180 to 180, 0 to 360 degrees
Transfer Func Coherence	0 - 1
Transfer Func Real	V/V, EU/EU
Transfer Func Imaginary	V/V, EU/EU
Nyquist Function	V/V, EU/EU
Cross Spectrum Magnitude	V^2rms, V^2p, V^2 p-p, EU^2rms, EU^2p, EU^2p-p
Cross Spectrum Phase	-180 to 180, 0 to 360 degrees
Cross Spectrum Real	V^2rms, V^2p, V^2p-p, EU^2rms, EU^2p, EU^2p-p
Cross Spectrum Imaginary	V^2rms, V^2p, V^2 p-p, EU^2rms, EU^2p, EU^2p-p
Octave Spectrum (Option)	Vrms, EUrms

Display Function	Log
Time Trace	
Compressed Time	
Orbit	
Magnitude Spectrum	Vrms, Vp, Vp-p, EUrms, EUp, EUp-p, V^2/Hz, EU^2/Hz, dB, dBV, dBR
Transfer Func Magnitude	V/V, EU/EU, dB, dBV, dBR
Transfer Func Phase	
Transfer Func Coherence	
Transfer Func Real	
Transfer Func Imaginary	
Nyquist Function	
Cross Spectrum Magnitude	V^2rms, V^2p, V^2 p-p, EU^2rms, EU^2p, EU^2p- p, dB, dBV, dBR
Cross Spectrum Phase	
Cross Spectrum Real	
Cross Spectrum Imaginary	
Octave Spectrum (Option)	Vrms, EUrms, dB, dBV, dBR

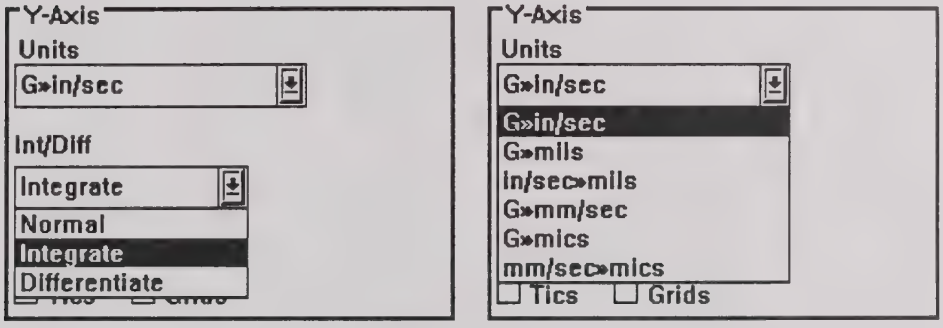
Int/Diff (Magnitude Spectrum Only)

For Magnitude Spectrum Traces, the data can be displayed normally, or integrated or differentiated. When Magnitude Spectrum is selected as the Display function, an Int/Diff combo box is displayed. From this you may select:

- **Normal**
- **Integrate**
- **Differentiate**

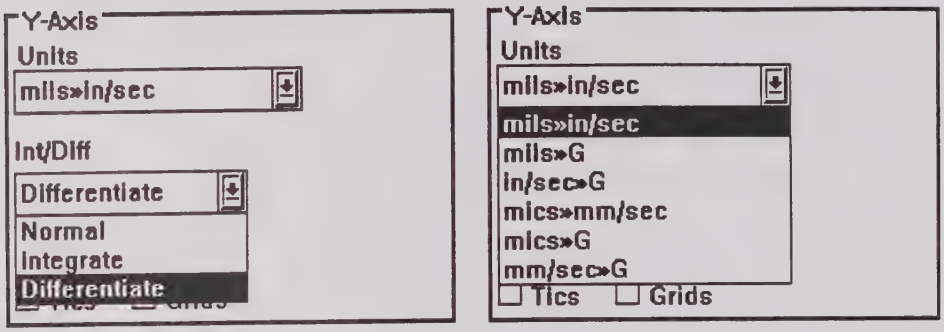
When Normal is selected, the Units as listed in **Units (Y-Axis)** appear in the Units combo box for selection.

When Integrate is selected, the following illustration and table show the choices of units that appear in the Units combo box, and their meaning:



Units	English/Metric	Operation
g's → in/sec	English	Integration
g's → mils	English	Double Integration
in/sec → mils	English	Integration
g's → mm/sec	Metric	Integration
g's → mics	Metric	Double Integration
mm/sec → mic	Metric	Integration

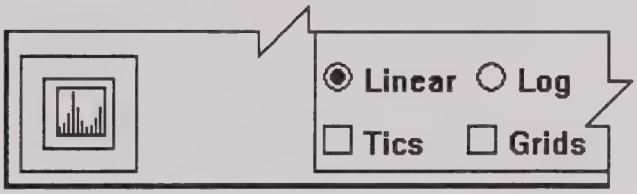
When Differentiate is selected, the following illustration and table show the choices of units that appear in the Units combo box, and their meaning:



Units	English/Metric	Operation
mils ➞ in/sec	English	Differentiation
mils ➞ g's	English	Double Differentiation
in/sec ➞ g's	English	Differentiation
mics ➞ mm/sec	Metric	Differentiation
mics ➞ g's	Metric	Double Differentiation
mm/sec ➞ g's	Metric	Differentiation

Integration and Differentiation are accomplished by dividing or multiplying the data by $2\pi f$, and by applying the appropriate units scaling and conversion factors.

Scaling (Y-Axis)

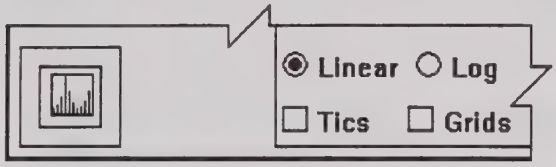


The scaling radio button group determines the scale for the axis - linear or logarithmic (base 10). If one of the scaling types is invalid for the selected display function, the scaling defaults to the valid scaling type and the control corresponding to the invalid scaling type is grayed.

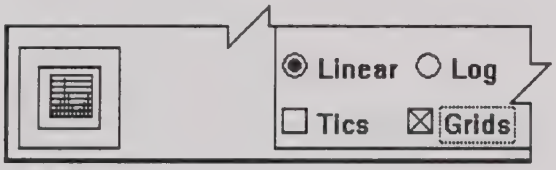
Grids and Tic Marks (Y-Axis)

Grids and Tic Marks for this axis can be independently selected by choosing the desired options:

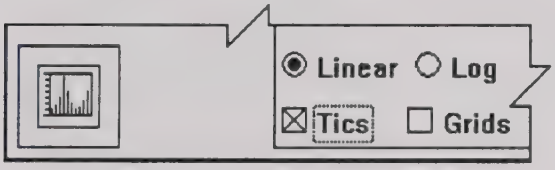
Open - no grids or tic marks; deselect both grid and tic options.



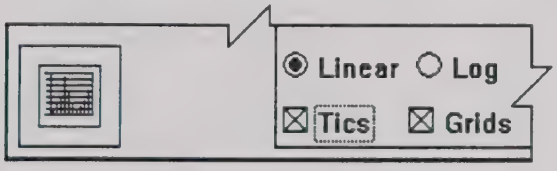
Grids Only - select the grid option.



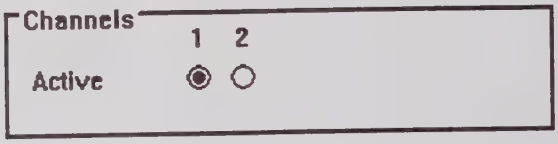
Tics Only - select the tics option.



Grids and Tics - select both the grid and tic options.



Channels Group



The channels group is used to select which channel(s) will be used as the source for the trace data.

Active

The active channels radio button group allows you to select one active channel to be used as the source of the trace. The enabled channels are determined by the active channels selected in the Analysis Setup Dialog input group.

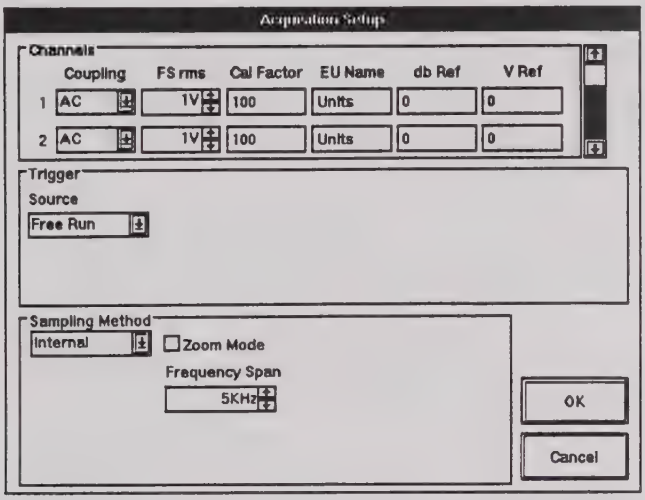
☞ *There must always be a single active channel for each display.*

Reference

The reference channels radio button group allows you to select one active channel to be used as a reference channel when displaying transfer function or cross spectrum traces.

☞ *For ORBIT Traces, the reference channel is the X Axis Channel.*

Acquisition Setup



The Acquisition Setup Dialog is used to set up the channel, trigger, and sampling parameters. These include:

- **Channel Coupling**
- **Channel Full Scale**
- **Channel Calibration Factors**

  mV to EU Conversion Factor

  dB and Voltage Reference Factors
- **Trigger Source**
- **Trigger Channel Delays**
- **Trigger Slope**
- **Trigger Threshold**
- **Frequency Span**
- **Zoom Center Frequency**

All acquisition parameters are global to the SD390. Changing them may cause incompatibility between live data being collected and data currently in the averager. If such incompatibility is detected, the averager will cease averaging and you will not be able to resume averaging. The averager must be explicitly restarted (thus clearing the current averager contents) to perform averaging with the new acquisition parameters.

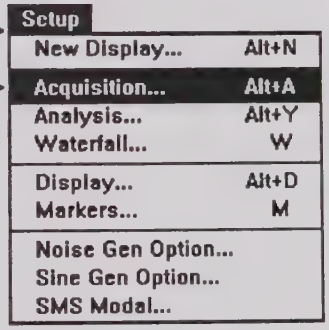
How To Invoke

To invoke the Acquisition Setup dialog:

➤ **Use the trackball to:**

Select the **Setup** menu

Select **Acquisition**



➤ **Or use the keyboard and:**

Hold down the **ALT** key and press the **A** key,

or

Press the **F5** function key,

or

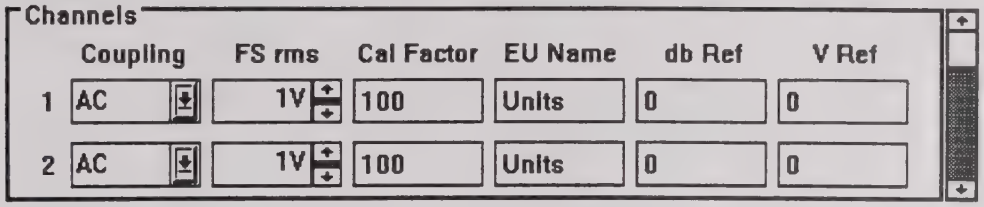
Press the **ACQUI** Function button

Acquisition parameters are not set until the **OK** button at the bottom right corner of the dialog is pressed. Selecting **Cancel** causes the dialog to disappear without affecting the acquisition parameters.

SD390 Hint

When beginning a data acquisition/analysis task, the acquisition parameters should be set up first and remain in effect until the task has been completed.

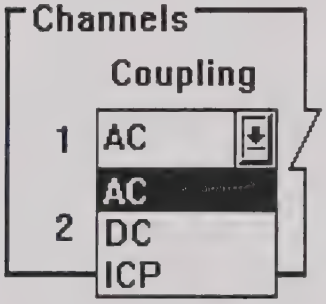
Channels Group



The channels group is used to set up the SD390's channel parameters. Channels are configured here, but are activated on the **Analysis Setup** Dialog. The SD390 can have up to 8 channels installed, 2 channels per card, and will "recognize" how many cards are installed.

Each channel has its own parameters. Two channels appear in the Channels scroll box at a time, and the next group of two channels can be selected by moving the scroll bar.

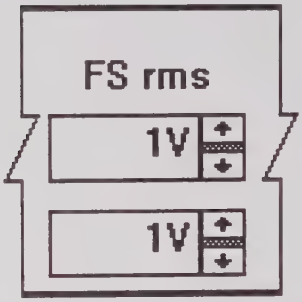
Coupling



Coupling is selected on a channel-by-channel basis using the coupling combo box. There are three choices for channel coupling:

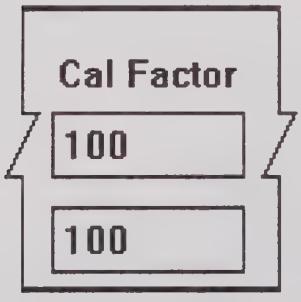
- **AC Alternating current signal source. The dc component is rejected.**
- **DC Direct current signal source. Both the ac and dc components are accepted.**
- **ICP Integrated Circuit Piezoelectric power source (transducer) 4 mA at 24 Vdc.**

FS rms (Full Scale Voltage)



Channel full scale is set on a channel-by-channel basis using the full scale scroll box. Full scale range is from 10 mV to 20 V selected in a 1, 2, 5 sequence giving a total of eleven full scale ranges. Clicking on the up/down arrow increases/decreases the full scale voltage for the specified channel to the next higher/lower level respectively. **AutoRanging** for a particular channel may be set by clicking one level above 20V. When AutoRanging is activated, the most suitable gain based on the signal for the indicated channel will be selected. AutoRanging will be performed when the Dialog is ended, and when data acquisition resumes. The value that was selected during AutoRange will appear in the FS rms field the next time the Acquisition Dialog is entered.

Cal Factor (Calibration Factor)

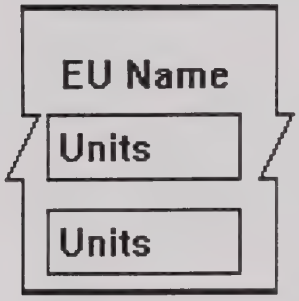


The calibration factor is used to convert channel voltage (in mV) to a more convenient unit of your choice (called an Engineering Unit, or EU for short). All displays in the SD390 are capable of using EU's for the units, in addition to the predefined units available. The calibration factor is then used to convert from voltage units to EU's.

The calibration factor is set by clicking inside the text box once to make it the active control, then double clicking inside it to bring up the **Virtual Calculator** which can be used to input or calculate the appropriate numerical value (accurate to 3 decimal places). The calibration factor is always entered in mV (i.e., the number of millivolts equivalent to 1 EU).

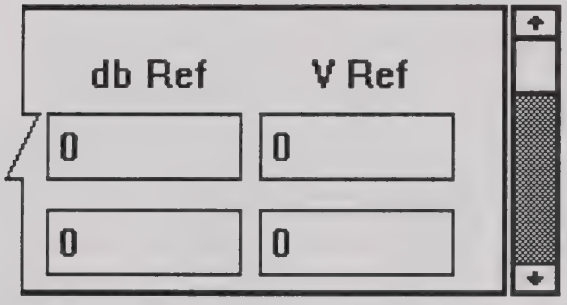
To enter the inverse (e.g., the number of EUs observed at 1 Volt rms), use the Virtual Calculator to divide the observed voltage (in mV) by the observed EU quantity, and press enter.

EU Name (Engineering Units)



EU's can be set using the **Virtual Keyboard** in the same manner as the calibration factor, or can be typed from a keyboard, if it is available. An EU Name can be any string of characters from 1 to 6 characters in length.

dB Ref (dB Reference) and V Ref (Reference Voltage)



For acoustic measurements, a reference voltage (V Ref) can be equated to a dB Reference value by entering these two quantities in their appropriate text boxes. These values are used to calculate the dB amplitude in relationship to the entered quantities when the DBR Y UNITS Selector is chosen for a display.

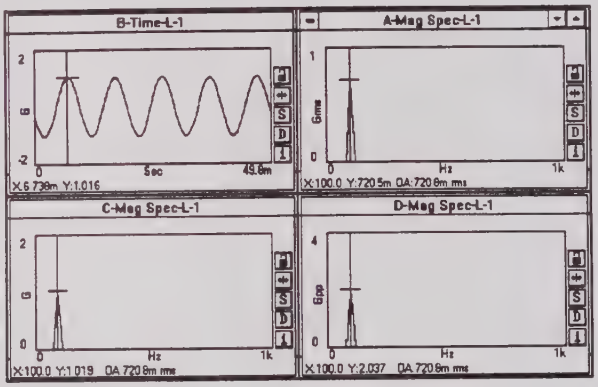
☞ *A dB Reference can be entered independently from, or in addition to, the calibration factor. The default dB ref is 80 dB at 0 volts.*

☞ *All entered Channel's calibration data is saved when a* ***.cfg*** *file is saved.*

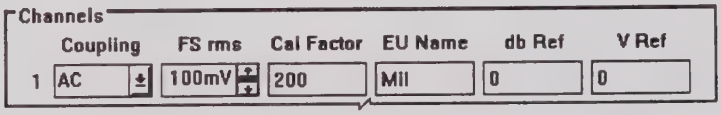
Calibration Examples

Assume an accelerometer transducer sensitivity is 100 mV/g. The **Cal Factor** and **EU Name** are entered as shown in the following example:

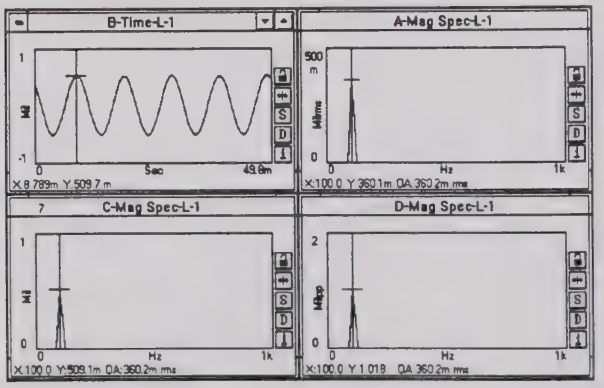
If a nominal 100 mV 0-p sine wave is generated by the accelerometer, the SD390 acceleration readouts will be as shown in the following display examples:



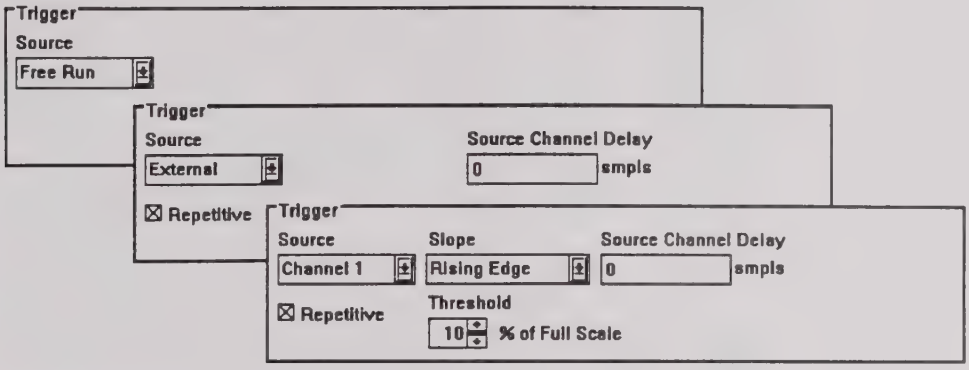
Assume a displacement transducer sensitivity of 200 mV/Mil. The **Cal Factor** and **EU Name** are entered as shown in the following example:



If a nominal 100 mV 0-p sine wave is generated by the displacement probe, the SD390 acceleration readouts will be as shown in the following display examples:



Trigger Group

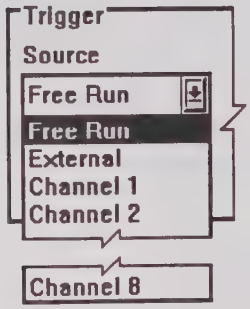


The trigger group is used to set the parameters that control triggered acquisition in the SD390. Triggering is not available when Zoom is enabled.

In triggered data acquisition, the SD390 does not begin processing data until some event, or trigger, occurs. The amount of data collected is equal to a single block of data set in the Input Group of the **Analysis Setup** Dialog, plus the negative delay number of samples, *or,* the positive delay number of samples. Negative delay samples are included as *part* of the data block. Positive delay samples are *outside* the data block.

You can set parameters to perform sampling only upon the first trigger or to repeatedly collect data upon every trigger. You can also specify the characteristics of the trigger, whether it is a TTL signal coming from an external trigger (tachometer) input or an analog signal coming from one of the channels. You can also control how soon data will be collected after (or before) the trigger occurs.

Source

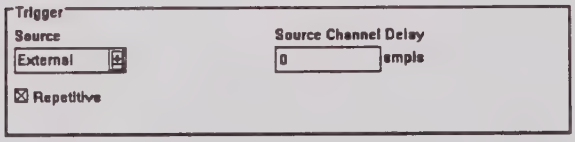


The trigger source is selected using the source combo box. There are three choices for trigger source:

➤ Free Run

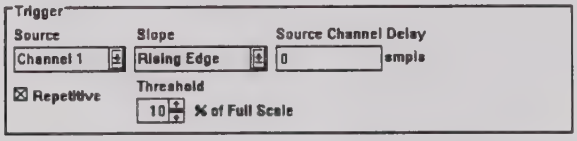
In free run mode, data is acquired constantly, at the maximum rate allowable given the current number of tasks being processed.

➤ External



In external triggering, data is acquired time-relative to a TTL input signal on dedicated trigger line.

➤ Channel 1 ➡ 8



In channel (internal) triggering, data is acquired relative to the input signal on the specified channel.

When operating at 100 kHz, the first active channel *must* be the trigger channel.

☞ *Depending on the trigger source, other trigger options are either enabled or disabled.*

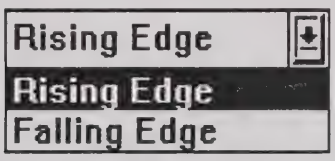
Repetitive

☒ Repetitive

The repetitive checkbox determines whether data will be collected only upon the first trigger or upon each successive trigger.

☞ *Enabled for **External** and **Channel** trigger sources only*

Slope



The slope combo box is used to select the type of edge (rising or falling) to be used for the trigger. Used in conjunction with the trigger threshold, the slope eliminates ambiguity in the trigger specification for analog signal triggering.

➤ **Rising Edge**

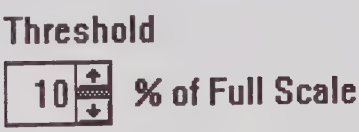
The rising edge (increasing voltage) of the signal at the specified threshold level will serve as the trigger.

➤ **Falling Edge**

The falling edge (decreasing voltage) of the signal at the specified threshold level will serve as the trigger.

☞ *Enabled for **Channel** trigger source only.*

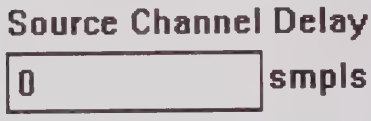
Threshold



The threshold scroll box is used to set the threshold (in terms of a percentage of the channel full scale voltage) for analog signal triggering. Any signal (with the appropriate slope; see preceding description) exceeding the threshold voltage will be used as the trigger. The threshold is an integer percentage in the range from -99% to 99% selectable in increments of 1%.

☞ *Enabled for* ***Channel*** *trigger source only.*

Source Channel Delay

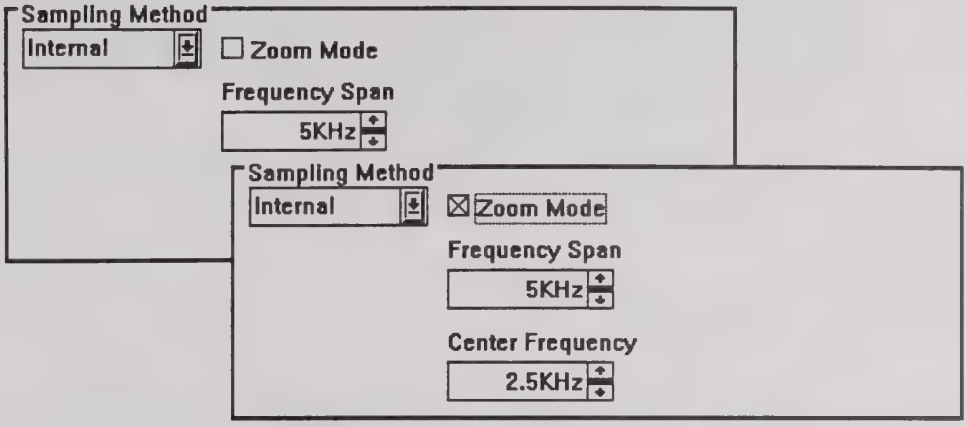


The source channel delay textbox is used to set the delay, in sample count, between the trigger and the start of data collection. This delay is for all channels and is an integer in the range not to exceed the **Extended Recorder Memory** size.

A positive delay causes post-triggering. The data block is collected *after* the trigger. A negative delay results in pre-triggering. Data is retained *before* the trigger event.

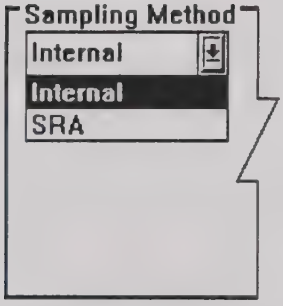
☞ *Enabled for* ***External*** *and* ***Channel*** *trigger sources only.*

Sampling Method Group



The Sampling Method Group is used to control the sampling rate parameters for the SD390. These controls are global to the SD390, so changing them may cause incompatibility between live data being collected and data already in the averager.

Sampling Method



The sampling method menu controls how the sampling will be performed. The choices are:

- **Internal Clock**
- **SRA (Option)***

The internal clock generates a sampling frequency that is proportional to the requested analysis range for the requested analysis mode. (The actual digital acquisition rate is a combination of the clock sampling rate and digital decimation). For spectral processing in Baseband Mode, (including time based analysis), this rate is 2.56 times the Frequency Span. For Zoom processing, the rate is calculated to provide the required zoom span for the requested center frequency. In the Octave mode, the rate is set to 2.56 times the upper frequency of the highest requested band.

***SRA** is only available if the **SRA option** is installed. Otherwise, **Internal Clock** sampling generation is the only available selection.

Zoom Mode

The zoom mode checkbox is used to toggle between the baseband and zoom modes when spectral processing modes are enabled. If the box is not checked, baseband mode is in effect. Otherwise, the SD390 is in zoom mode. This mode (baseband/zoom) affects the operation of the frequency span and center frequency scroll boxes on this dialog, and the Frequency Control indicator in the Display Windows.

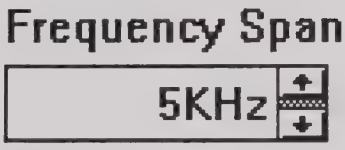
Real Time Zoom (i.e. no data gaps) can be performed up to a range of 10 kHz, providing that (Center Frequency + 1/2 Frequency Span) does not exceed 10 kHz. Above this range, pseudo-real time processing is in effect. This means that enough data to perform the zoom transform is first acquired to XRec Memory, then the data is processed (and optionally averaged and/or displayed), then more data is acquired. Therefore, there are data gaps proportional to the time it takes to perform the zoom transform on each channel. At very deep levels of zoom, this time can approach 5 - 10 seconds. The displays and averager will not update until a complete zoom transform is performed.

The level, or frequency span, of zoom above 10 kHz is directly proportional to the amount of available XRec Memory selected on the Analysis Dialog. The default setting of 32768 samples is sufficient for a zoom of 20:1 at 20 kHz with a resolution of 400 lines. For deeper zoom factors, you must increase the amount of available XRec Memory. The minimum zoom span is enforced by the SD390, but is configurable by changing the amount of available XRec Memory.

SD390 Hint

If you need to select zoom above 10 kHz, set XRec memory to the maximum available to obtain the deepest zoom factor possible. Other methods include decreasing the number of channels, and selecting a different Analysis mode.

Frequency Span



The frequency span scroll box allows you to select the frequency span for Spectrum (FFT-based) and Octave (digital filter based) analysis.

For Spectrum analysis, the frequency span can be set to any frequency range from 1 Hz to 100 kHz (for 2 channel operation), or 1 Hz to 40 kHz (for 3-8 channel operation) in a 1, 2, 4, 5 sequence. Clicking on the up arrow increases the frequency to the next higher range, while clicking on the down arrow decreases the frequency to the next lower range.

In Real Time Zoom Mode, the frequency span can be set to any frequency range from 5 Hz to 10 kHz, (as long as the new frequency span is in the range [5 Hz, min(center frequency, 10 kHz - center frequency)]. In Pseudo-Real Time Zoom, the minimum frequency span is limited by the amount of available XRec Memory.

☞ *The frequency span may also be changed by using the Frequency Control while a Display is available, described in the section on the Frequency Control.*

Center Frequency

The center frequency scroll box is used to set the center frequency for Zoom Mode operation.

The center frequency can be set to any value in the range [frequency span/2, 100 kHz - frequency span/2] (for 2 channel operation) or [frequency span/2, 40 kHz - frequency span/2] (for 3-8 channel operation) in increments of 1 Hz. Clicking on the up arrow increases the center frequency by 1 Hz, while clicking on the down arrow decreases the center frequency by 1 Hz.

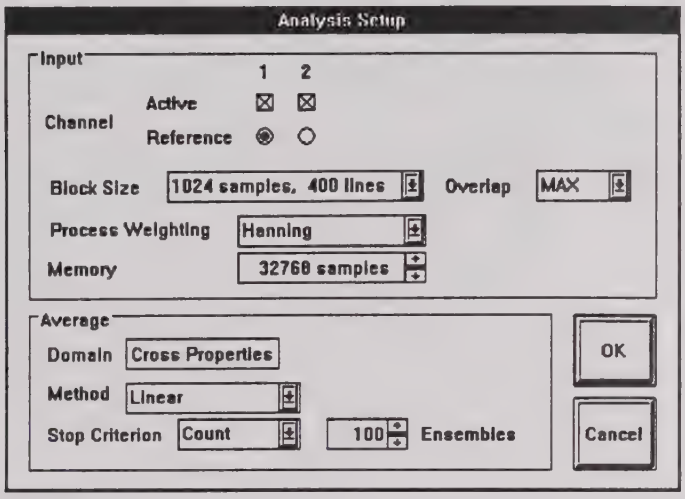
☞ *In Baseband Mode or Octave Analysis Mode, the center frequency scroll box is not displayed.*

The frequency span may also be changed by using the Frequency Control while a Display is available. This is described in the section on Frequency Control.

SD390 Hint

Due to the interrelationship between frequency span and center frequency for the FFT sampling method in zoom mode, it may be difficult to achieve the desired combination of frequency span and center depending on the order in which the two values are set. The best way to set these values is to set the frequency span first and then to select the center frequency.

Analysis Setup



The Analysis Setup Dialog is used to set the SD390 spectrum based data analysis parameters. These parameters are based on the current **Analysis Mode** of the analyzer. For **Spectrum** based analysis, these parameters include:

- **Active Channels**
- **Reference Channels**
- **Data Block Size**
- **Process Weighting (windowing)**
- **Overlap Factor**
- **Extended Recorder Memory Size**
- **Averager Domain (for information only)**
- **Average Method**
- **Average Stop Criterion**
- **Average Running Count Or Time**

All analysis parameters are global to the SD390. Changing them may cause incompatibility between live data being collected and data currently in the averager. If such incompatibility is detected, the averager will cease averaging and the instrument will not be able to resume averaging. The averager must be explicitly restarted (thus clearing the current averager contents) to perform averaging with the new acquisition parameters. *Changing the Active Channel List will invalidate all data in the Extended Recorder Memory, thus invalidating all live displays.*

How To Invoke

To invoke the Analysis Setup Dialog:

➤ **Use the trackball to:**

Select the **Setup** menu

Select **Analysis**

➤ **Or use the keyboard and:**

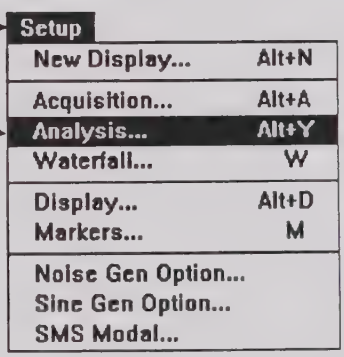
Hold down the **ALT** key and press the **Y** key,

or

press the **F6** function key

or

Press the **ANALY** Function button



Analysis parameters are not set until the **OK** button at the bottom right corner of the dialog is pressed. Selecting **Cancel** causes the dialog to disappear without affecting the analysis parameters.

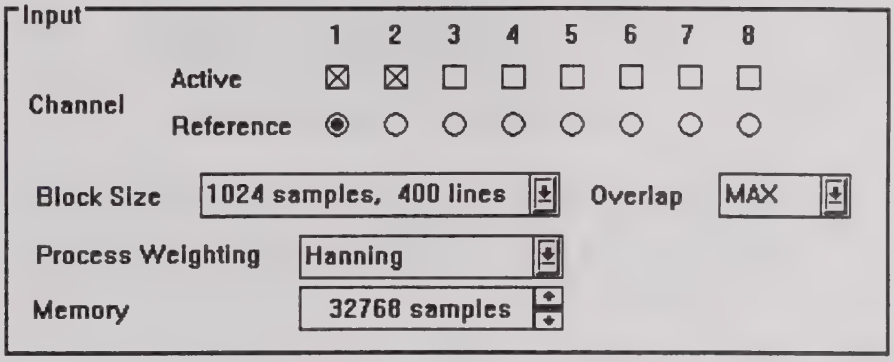
The following parameters are valid when the SD390 has one of the following Analysis Modes enabled:

➤ **Sync Spectrum**

➤ **Spectrum**

➤ **Cross Spectrum**

Input Group



The Input group is used to set the SD390's data collection and analysis parameters.

Active Channels

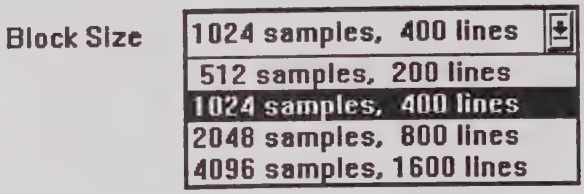
The active channel checkboxes are used to select which channels will be used for data collection. Those channels not designated as active will be ignored, thus freeing certain limited resources (such as memory) for use by channels of interest. There must be at least one active channel at any given time, but the number of active channels is limited only by the SD390 hardware configuration.

The maximum frequency range will be reset to 40 kHz if the current frequency range is 100 kHz and more than 2 channels are enabled.

Reference Channels

The reference channel checkboxes are used to select which of the *active* channels will be used as the reference channel for multi- channel analyses (such as transfer functions and cross products). Only a channel already designated as active can be used as a reference channel. This selector only appears when **Cross Properties** is selected as the analysis mode.

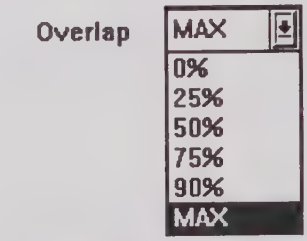
Block Size



Block size is selected using the block size combo box. The SD390 divides the continuous stream of data it collects into blocks to facilitate processing. The sizes for processing are specified both in terms of spectral lines (for FFT analyses such as magnitude spectrum) and number of samples. The available block sizes are:

512 Samples, 200 Lines
1024 Samples, 400 Lines
2048 Samples, 800 Lines
4096 Samples, 1600 Lines

Overlap



The overlap combo box is used to determine how much of the initial portion of a new data block is copied from the final portion of the previously collected data block. The percentage of overlap can be any of the following:

➤ **0%**

No overlap. The data trace update rate is the same as the block processing rate.

➤ **25%**

The first 25% of the new block is a copy of the last 25% of the old block, the last 75% of the new block consists of new data.

➤ **50%**

New block: Last 50% old block, 50% new data.

➤ **75%**

New block: Last 75% old block, 25% new data.

➤ **90%**

New block: Last 90% old block, 10% new data.

➤ **MAX**

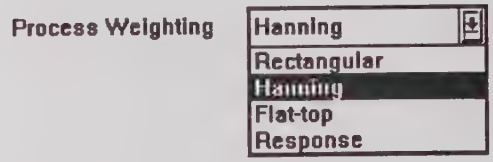
For live analyses, the maximum overlap available is dependent upon the selected frequency span (see Acquisition Setup).

For data played back from the recorder memory, the maximum overlap is 90%. This technique is used primarily to improve the statistical average at low sampling frequencies.

☞ *Overlap is ignored (set to 0%) for triggered data.*

Since traces are displayed on a block-by-block basis, the display update rate can be limited by the rate at which blocks are produced. By using overlap, a new block is partially filled in with values from the previous block, thus speeding up trace display. Trace update and display refresh may not occur at the same rate.

Process Weighting



The process weighting combo box controls the type of weighting function (also known as a window) that will be applied in performing the Fast Fourier Transform (FFT) on blocks of time data. Weighting can reduce several sources of analytical error (see **FFT Weighting** in Section 8, References).

First of all, the length of the signal represented by the block of time data may not be an integral multiple of the signal's period (the Fourier Transform is meaningful only on periodic signals). This means that the FFT of the time data block will produce a spectrum that is not faithful to the true spectrum of the signal due to "flaring" at each component frequency. Weighting can be used to modify the time data block to artificially produce periodicity so that the resultant spectrum is much closer (but still not identical) to the actual spectrum than without weighting.

Secondly, it is often desirable to preserve certain features of the signal spectrum produced by the FFT while still reducing flaring. For example, some weightings preserve spectrum amplitude while others preserve spectrum frequency. Other weightings are used as filters to enhance or modify spectra to suit various requirements.

The SD390 supports the following types of weighting:

➤ **Rectangular**

No weighting at all (flat weighting over entire block).

➤ **Hanning**

A type of weighting which preserves the frequency resolution of signal spectra while sacrificing amplitude resolution.

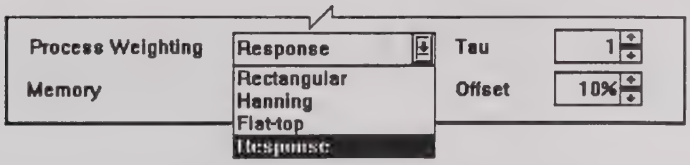
➤ **Flat-Top**

A type of weighting which preserves the amplitude resolution of signal spectra while sacrificing frequency resolution.

➤ **Response**

This is a special type of weighting used in impact/response testing to damp signals from lowly damped system responses.

Tau



The **Tau** scroll box controls the rate of exponential decay for response weighting. Tau is an integer in the range (1 ➟ 15), and can be set in increments of 1. Higher values resulting in more pronounced signal damping (thus reducing the effects of object ringing in the force/response test).

The decay is given by the equation:

DECAY = 1 - e^{-Tau} (for amplitude attenuation within a data block)

Tau	Decay
1	63.21205588%
2	86.46647168%
3	95.02129316%
4	98.16843611%
5	99.3262053%
6	99.75212478%
7	99.9088118%
8	99.96645374%
9	99.98765902%
10	99.99546001%
11	99.99832983%
12	99.99938558%
13	99.99977397%
14	99.99991685%
15	99.99996941%

☞ *Enabled for **Response** process weighting only.*

Offset

The offset scroll box controls the delay offset between the trigger and the beginning of signal damping to suppress ringing for response weighting. Offset is an integer percentage in the range (10% ➟ 80%) and can be set in increments of 1%. Higher percentages result in greater delays between the trigger and the beginning of signal damping.

☞ *Enabled for **Response** process weighting only.*

Memory

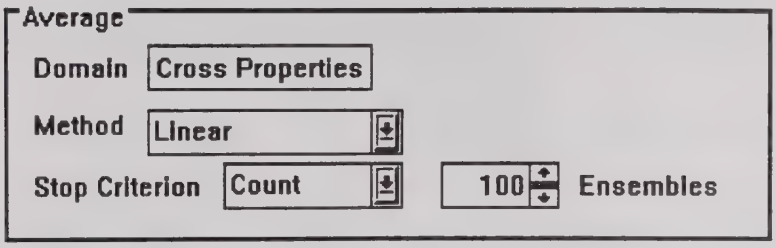
The amount of desired Extended Recorder Memory can be selected from a minimum of 8192 samples per channel to a maximum proportion on the **Mode** Menu. The maximum number of samples is also calculated by the Analysis Mode, number of active channels, and Block Size.

Use the scroll arrows to increase or decrease the amount of memory which will be allocated to the Extended Recorder. As the maximum available memory may change as other parameters change, you may be able to gain additional memory by pressing the up arrow. Conversely, parameter changes may decrease the amount of available memory, so verify the number in this field when changes are made to other parameters.

A large amount of Extended Recorder Memory may be required for deep zoom levels above 10 kHz, or if long transients at high frequencies are to be captured. A small Recorder Memory may be useful when short transients are to be captured and re analyzed.

For more information on the Extended Recorder Memory see Section 8, More on Extended Memory.

Average Group



The average group is used to set the SD390's ensemble averaging parameters.

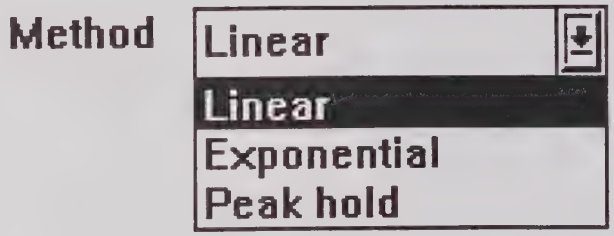
Domain

The domain information box identifies which Averager can be activated. The domain is set from the **Mode Configuration** menu.

The Averager partially determines the types of analyses and displays that can be produced. See data sources in the **Display Dialogs** for more information.

The availability of certain trace displays is affected by the current average domain. The factory default Domain is set for Cross Properties. See the table in the description of the Display Setup Dialog's display type control.

Method



Ensemble averaging is analogous to averaging numbers and involves the combination of a sequence of traces to produce a trace which is an "average" of the sequence.

Averaging can be used to "even out" variations in the signal spectrum in order to determine typical or average signal behavior. In a similar manner, Time Domain averaging can also help eliminate the effects of random signal noise. During Time Domain averaging, the meaningful component of the signal will tend to reinforce itself while the noise component will tend to cancel itself out, using a **Triggered Acquisition** mode.

There are several different types of averaging differing in the manner in which each component trace contributes to the average of the traces as a whole. For example, all traces could contribute evenly to the average. Alternatively, new traces might contribute more to the average than traces acquired in the past. Each type of averaging has its own set of applications.

The SD390 supports three different methods of averaging.

➤ **Linear**

In linear averaging, each trace contributes equally to the average. The value at any point in the linear average is given by the equation:

AVG = (SUM OF TRACES)/(# OF TRACES)

The advantage of this averaging method is that it is fast to compute. However, this method is suitable only for shorter sequences of traces since the average tends to stabilize due to the finite resolution of the analyzer. The contribution of new traces eventually will cease to change the value of the average no matter how great or small the magnitude of the trace components.

➤ Exponential

In exponential averaging, traces do not contribute equally to the average. New traces are weighted more heavily than old ones. The value at any point in the exponential average is given by the equation:

$$\mathbf{AVG = [OLD\ AVERAGE \times (1\text{-}1/S)] + [NEW\ TRACE \times (1/S)]}$$

The advantage of this averaging method is that it can be used indefinitely. That is, the average does not converge to some value and stay there as is the case with linear averaging. The average will dynamically respond to the influence of new traces and gradually ignore the effects of older traces. The constant **S** (Averaging Criterion) controls how heavily the average will be biased in terms of new traces. When **S**= 0, the average is simply the current trace (live). If **S** is very large, the average never changes. Other values of **S** cause a gradual, non-linear "smoothing" of the average from live (dynamic, noisy) when **S** is small, to constant (gradual, less noisy) when **S** is large (>1,000).

The Averaging Criterion, **S**, is set in terms of the number, or count, of averages.

The effect of the Averaging Criterion is not linear. An Averaging Criterion of 100 averages does not result in a trace that is 10 times as smooth as a trace produced with an Averaging Criterion of 10 averages.

➤ Peak Hold

This method, technically speaking, does not involve averaging in the strict sense of the word. Instead, the "average" produced by the peak hold method produces a trace that at any point represents the maximum corresponding point among all the component traces. The value at any point in the peak hold "average" is given by the equation:

AVG = MAX(ALL TRACES)

Peak hold is useful for maintaining a record of the highest values attained at each point throughout the sequence of traces.

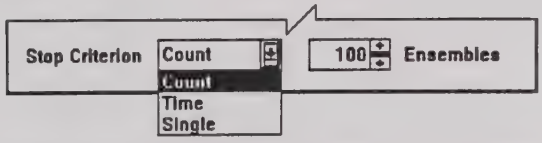
For Cross Property averaging, a slight variation on the standard peak hold algorithm is used, which makes peak averaging for this domain very useful in such applications as swept sine excitation testing. A new peak spectrum is added to all channels in the averager only when the peak spectrum exceeds the previous aver aged spectrum for the reference channel. The effect of this is that the data in the averager contain data only at the instant of maximum response on the reference channel. The noise at all other instances is not added to the averager.

To use this mode effectively, the reference channel must be the drive channel, and it is assumed that the response from the active channels (for a sine sweep) is greater at the drive frequency than the noise. The transfer function, magnitude and phase is indeed meaningful even though the average is based on samples at each bin over different periods of time. The actual result is the response at each bin to a nearly bin centered sinusoid.

Stop Criterion

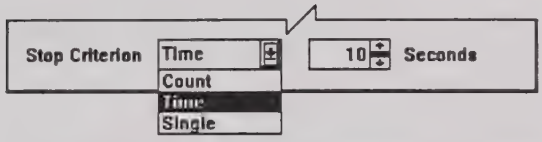
The stop criterion combo box is used to select whether the averager will stop on the basis of elapsed time or number of ensembles collected, or if single (manual) averaging will be performed.

➤ **Count**



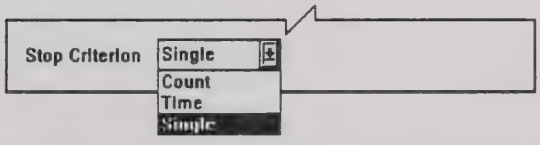
Averaging will stop after specified number of ensembles have been collected. This is the preferred method when the time data is continuous or when the measurement size is defined.

➤ **Time**



Averaging will stop after specified number of seconds time have elapsed. This is the preferred criterion where the interval over which to collect the data is known (e.g. taped data).

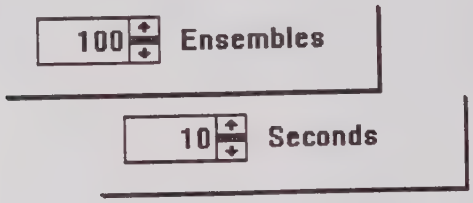
➤ **Single**



Averaging is performed manually, on a trace-by-trace basis, via the averager single control, located in the averager group of the Control Area. This is the preferred method for interactively selecting the ensembles based on more complex criteria.

Single Averaging must be used with **Single Trigger** Acquisition.

Ensembles/Seconds



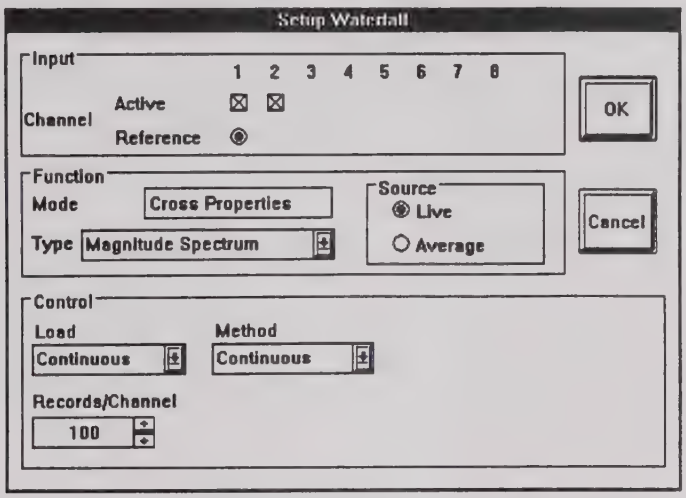
The Ensembles/Seconds scroll box is used to set the number of ensembles if the stop criterion is **Count**, or seconds if the stop criterion is **Time**.

The range for ensembles is (1 ➡ 10,000). You can also select MAX ensembles by scrolling down once from 1 ensemble. In MAX mode, the averager will continue until it is manually stopped using the averager stop control, located in the averager group of the Control Area.

The range for seconds is (1 ➡ 86,400 where 86,400 seconds = 24 hours). You can also select MAX seconds (24 hours) by scrolling down once from 1 second.

☞ *Enabled for **Count** and **Time** stop criteria only.*

Waterfall Setup



How To Invoke

The Waterfall Setup Dialog is only available when Waterfall is enabled from the **Mode Configuration** menu. This dialog is used to set the Analyzer's waterfall load parameters.

To invoke the Waterfall Setup Dialog to set Waterfall Load parameters:

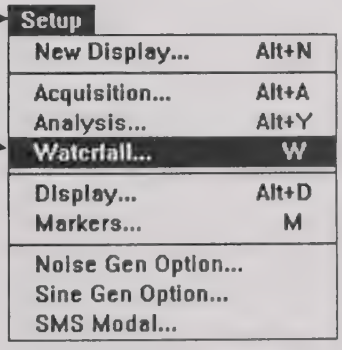
➤ **Use The trackball to:**

Select the **Setup** menu

Select **Waterfall**

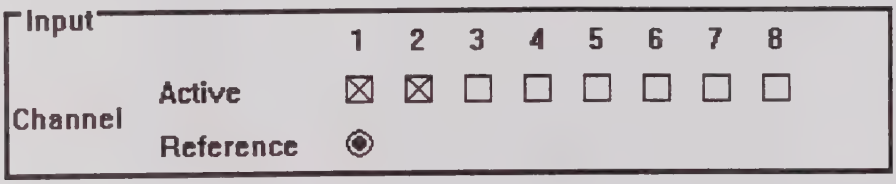
➤ **Or use The keyboard and:**

Press the **W** Key.



New waterfall parameters are not created until the "OK" button at the bottom right corner of the dialog is pressed. Selecting "Cancel" causes the dialog to disappear without modifying the existing parameters.

Input Group



The channels group is used to select all or a subset of the currently active channels as specified on the Analysis Setup Dialog. The list of available channels appears as unfilled boxes. To select, or deselect, any channel to use for waterfall analysis, click on the box.

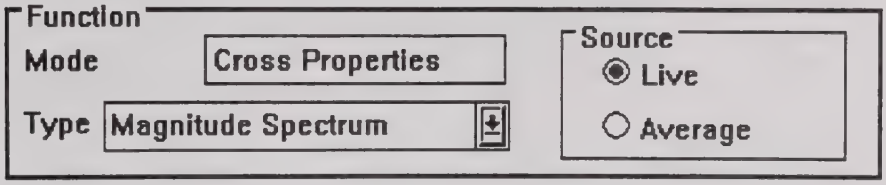
Active Channels

The active channel radio buttons are used to select which channels will be used for waterfall data collection. Those channels not designated as active will be ignored, thus freeing certain limited resources (such as memory) for use by channels of interest. There must be at least one active channel at any given time, but the number of active channels is limited only by the preselected Analysis Active channels.

Reference Channel

The reference channel radio button already designated as an Analysis Reference Channel is used as the reference channel for a Waterfall Function. This selector only appears when **Cross Properties** is selected as the Analysis Mode.

Function Group

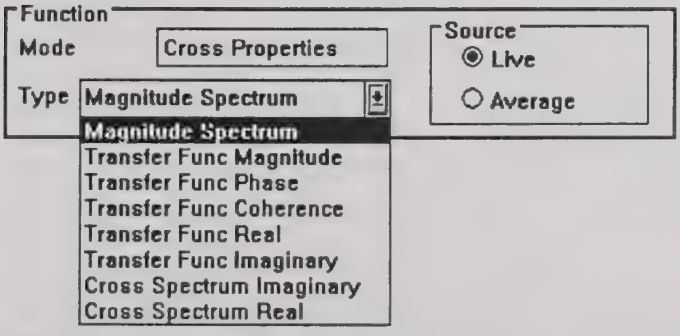


The Function group allows selection of the type of Waterfall analysis function that will be loaded into waterfall memory.

Mode

The mode box is an information field reminding you in which mode the analyzer is operating. The mode will determine which types of analysis functions are available to be waterfalled. This parameter cannot be changed on this dialog. This parameter is accessed from the **Mode** main menu.

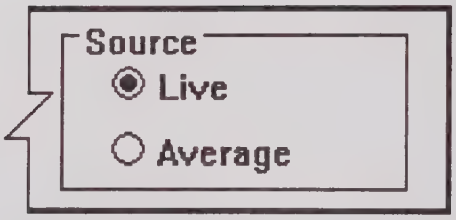
Type



This is a pull down combo box displaying the types of functions that can be loaded into waterfall memory for the selected mode. Only one function can be selected. The selected function applies to all active channels selected in the **Setup Waterfall Input** group

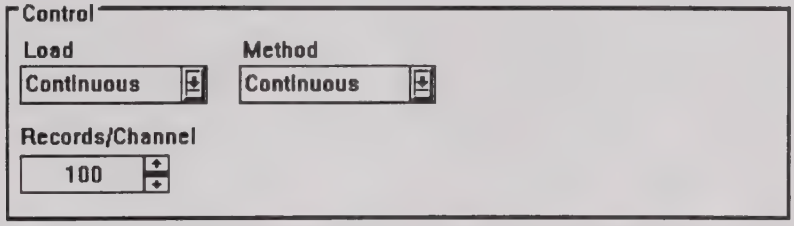
When the Analyzer Mode changes, you may have to reset the Waterfall Function to agree with the newly selected mode. If the Waterfall Control Buttons do not appear, make sure the Analyzer Mode and Waterfall Function are compatible.

Source



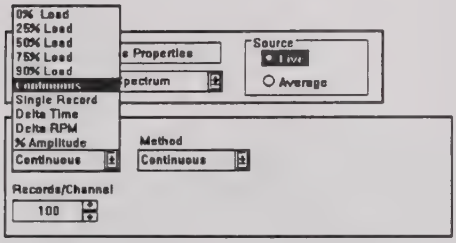
These radio buttons allow selection of the source of the function to be waterfalled; from LIVE, real-time data, or from the AVERAGER. The choice of the source will determine how the data can be loaded into waterfall memory and determines the contents of the **Control** group **Load** menu.

Control Group



The load controls determine how data is transferred from the source data area to the waterfall memory. The load control choices reflect the selected analyzer mode, data, source and acquisition choices that have been made, therefore only certain load controls may be available for a particular setup.

Load Control (Live Data Source)



This pull down combo box determines how waterfall memory will be loaded when the **Source** menu selection is **Live.**

0% Load

When one complete block of data is collected into LIVE memory, it is transformed into the desired Function and transferred to waterfall memory. The size of the data block is determined by the Block Size setting on the Analysis Dialog.

☞ *This control is only available for Live Spectrum or Cross Spectrum data.*

25% Load

When a block of data is collected it is transformed into the desired Function and transferred to waterfall memory. The first 25% of the new block of data is a copy of the last 25% of the old block; the last 75% of the new block consists of new data.

The size of the data block is determined by the Block Size setting on the Analysis Dialog.

☞ *This control is only available for Live Spectrum or Cross Spectrum data.*

50% Load

When a block of data is collected it is transformed into the desired Function and transferred to waterfall memory. The first 50% of the new block of data is a copy of the last 50% of the old block; the last 50% of the new block consists of new data. The size of the data block is determine by the Block Size setting on the Analysis Dialog.

☞ *This control is only available for Live Spectrum or Cross Spectrum data.*

75% Load

When a block of data is collected it is transformed into the desired Function and transferred to waterfall memory. The first 75% of the new block of data is a copy of the last 75% of the old block; the last 25% of the new block consists of new data. The size of the data block is determined by the Block Size setting on the Analysis Dialog.

☞ *This control is only available for Live Spectrum or Cross Spectrum data.*

90% Load

When a block of data is collected it is transformed into the desired Function and transferred to waterfall memory. The first 90% of the new block of data is a copy of the last 90% of the old block; the last 10% of the new block consists of new data. The size of the data block is determined by the Block Size setting on the Analysis Dialog.

☞ *This control is only available for Live Spectrum or Cross Spectrum data.*

Continuous

This control has two different functions based on the data source.

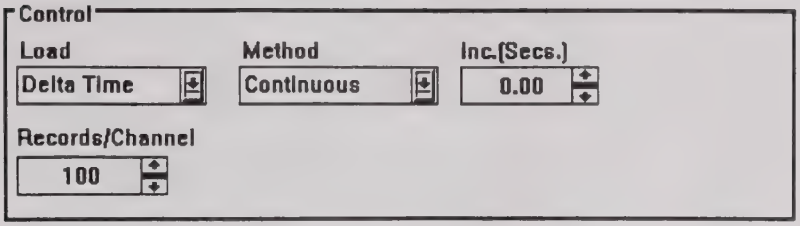
➤ **Live**

Data is transformed into the desired Function and transferred to waterfall memory as fast as the analyzer can collect and process the data. The rate of processing is dependent upon the function, selected number of channels and the number of active displays. Data is always block processed, but with very small overlap.

Single Record

This control allows manual load of the waterfall memory. Each time the Waterfall Start or Single (+1) load control button is pressed, data from the selected source is transformed and transferred to waterfall memory.

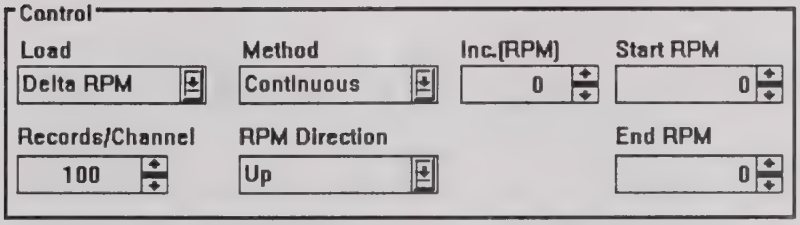
Delta Time



When Delta Time is selected, the Time Increment field appears to allow the time increment (in seconds) to be entered. When the time increment elapses, data in the source memory will be processed and transferred to waterfall memory. The resolution of the time increment is 0.10 seconds.

☞ *This load control is only available when the Trigger Source is* ***Free Run*** *on the Acquisition Setup dialog.*

Delta RPM



Data can be loaded into waterfall memory at specific RPM intervals, while accelerating, decelerating, or both accelerating and decelerating. Additional parameter fields appear when Delta RPM is selected:

➤ **RPM Direction**

Up for acceleration only
Down for deceleration only
Up or Dn for acceleration and deceleration

➤ **Inc. (RPM) - (RPM increment)**

When the system detects an RPM increment change, data is processed and loaded into waterfall memory.

➤ **Start RPM**

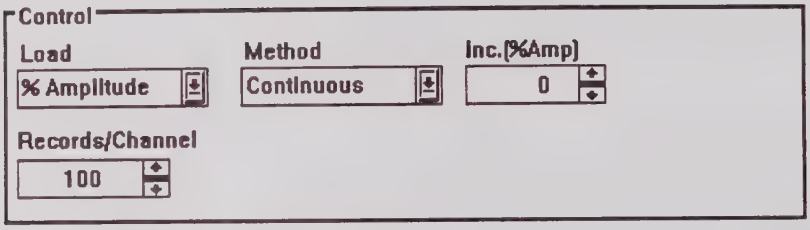
When the direction is UP or DOWN, the start RPM can be specified to indicate when the Waterfall Memory will start being loaded according to the specified increment.

➤ **End RPM**

When the direction is UP or DOWN, End RPM can be specified to indicate when the loading of Waterfall Memory will stop.

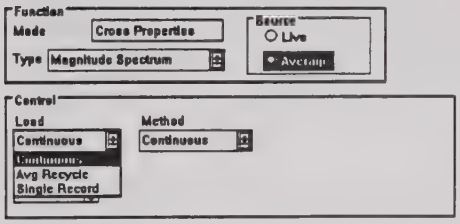
☞ *This load control is only available when **RPM** is enabled and the Trigger Source is **Free Run** on the Acquisition Setup Dialog.*

% Amplitude



When % Amplitude Load is selected, an Amplitude Value (in percent Full Scale) can be entered which will determine when the data from the selected source will be transformed and transferred to waterfall memory. When the amplitude (rms) of the first selected Waterfall channel from the selected waterfall source exceeds the indicated percent full scale amplitude, data from all channels will be processed and copied to Waterfall Memory.

Load Control (Average Data Source)



This pull down combo box determines how waterfall memory will be loaded when the **Source** menu selection is **Average.**

Continuous

This control has two different functions based on the data source.

➤ **AVG**

The averager control parameters (overlap, weighting, etc.) are used. When one block of data (according to the Averager overlap factor) is processed, the desired function is transferred to Waterfall Memory.

Avg Recycle

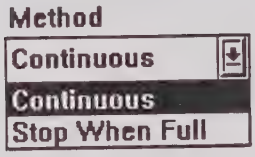
This load control is only available when the data source is from the Averager. Each time the Averager target count reaches the specified number, the data in the averager is copied to waterfall memory. Each copy produces one record for each selected waterfall channel. The averager is cleared, and the process begins again until the requested number of records has been copied to waterfall memory.

☞ *Avg Recycle forces the Averager to linear averaging, and Count Stop Method.*

Single Record

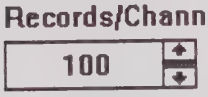
This control allows manual load of the waterfall memory. Each time the Waterfall Start or Single (+1) load control button is pressed, data from the selected source is transformed and transferred to waterfall memory.

Method



The load Method determines whether waterfall memory will be loaded Continuously or whether loading will **Stop When** waterfall memory is **Full**. When loading is continuous, data will wrap when waterfall memory is full. You must press the Stop Waterfall Load Control or the HOLD button to stop data from being loaded into waterfall memory.

Records/Channel



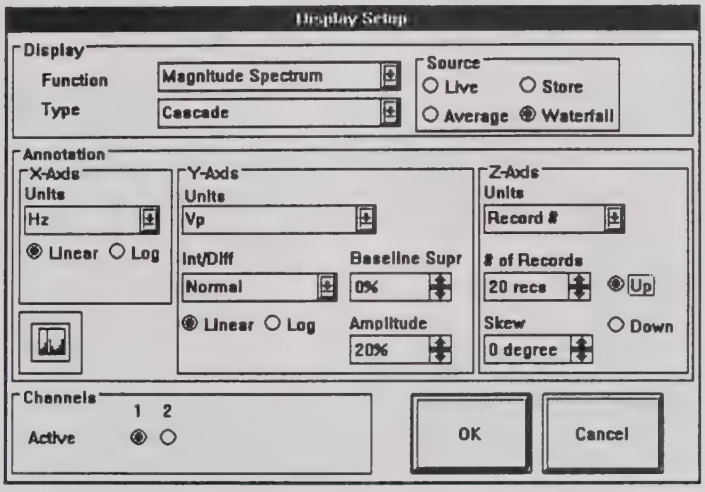
This parameter specifies the number of records per channel that will be collected before loading stops (when using the **Stop When Full** Load Method) or before data wraps (when using the **Continuous** load Method). The maximum number of records is set in the Mode Dialog.

The number of records for this dialog is the number of records per channel. The number of records on the Mode Dialog is the total possible number of records. The number of records per channel is determined by the total possible records, the current block size, and the number of active Waterfall channels.

Waterfall Display Setup

When the **Waterfall** checkbox on the **Mode Configuration** menu is selected, the **Waterfall** radio button on the Display Setup menu will be activated. Selecting Waterfall as the display source will allow access to displaying and manipulating data in the waterfall memory.

How to Invoke

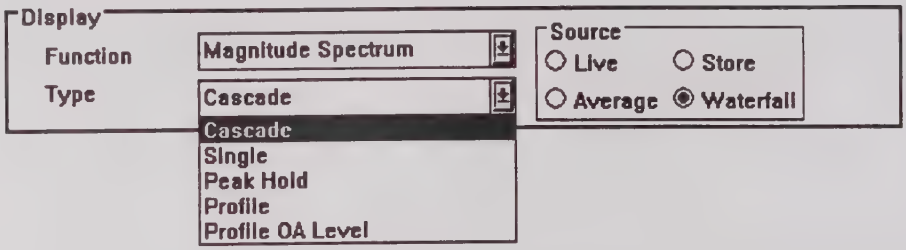


There are a number of fields and choices that are particular to Waterfall Displays. In addition to the previously discussed selections on the Display Setup Dialog, when Waterfall is selected from the Source group, there are additional display formats and parameters for selecting Z Axis and other waterfall-specific display features.

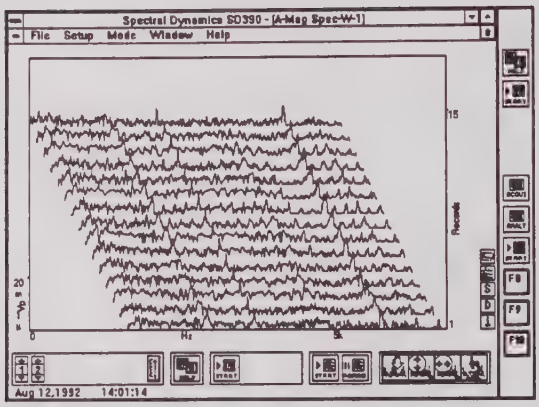
A step-by-step example for setting up a Waterfall display can be found in the sub-section that follows this one.

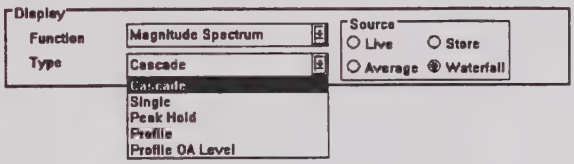
Display Type

Five waterfall Display Types are available:



Cascade



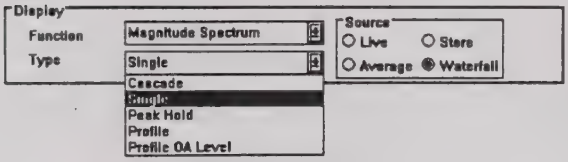


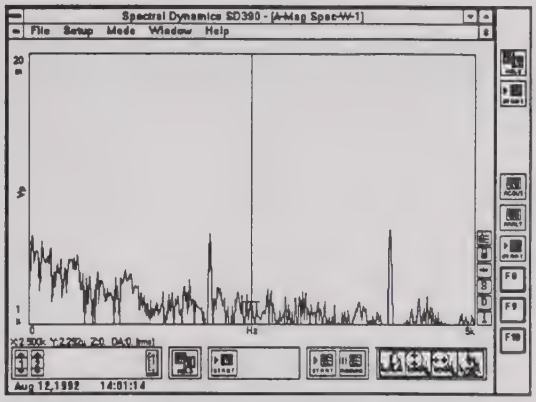
This is a traditional waterfall cascade display, which displays multiple individual Function traces on a single display. Traces can be displayed with the most recent trace on the bottom with older traces scrolling up, or vice-versa by selecting **Down** from the **Z-Axis** control group. Data can be displayed as it is being loaded into waterfall memory, and will be refreshed when the waterfall load stops.

Hidden Line Removal is always enabled for Cascade Displays. Selectable amplitude of a single trace, the number of traces to display, skew, and baseline suppression can enhance the viewing of cascaded data.

At fast acquisition rates, every trace that is collected may not be displayed during Live Load (i.e. as data is being collected). When the display is refreshed, all collected displays (within the specified range) will be shown.

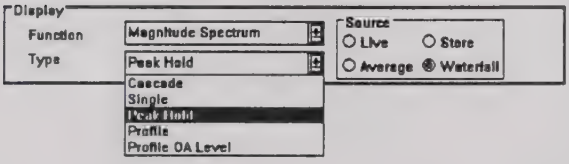
Single

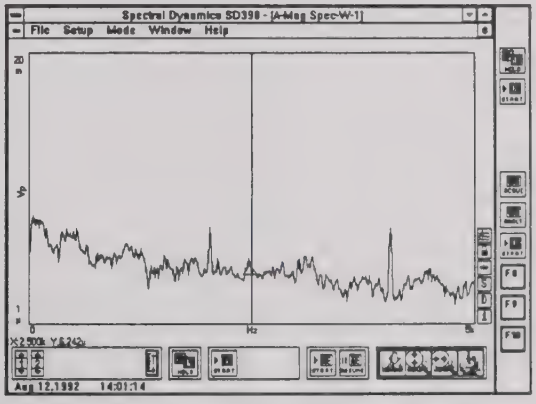




This option will display a single trace from Waterfall memory. It is an accurate representation of the most recent data being loaded into waterfall memory during LIVE load. During waterfall data recall, any individual record can be displayed from waterfall memory by using the Waterfall Record/Profile selection feature.

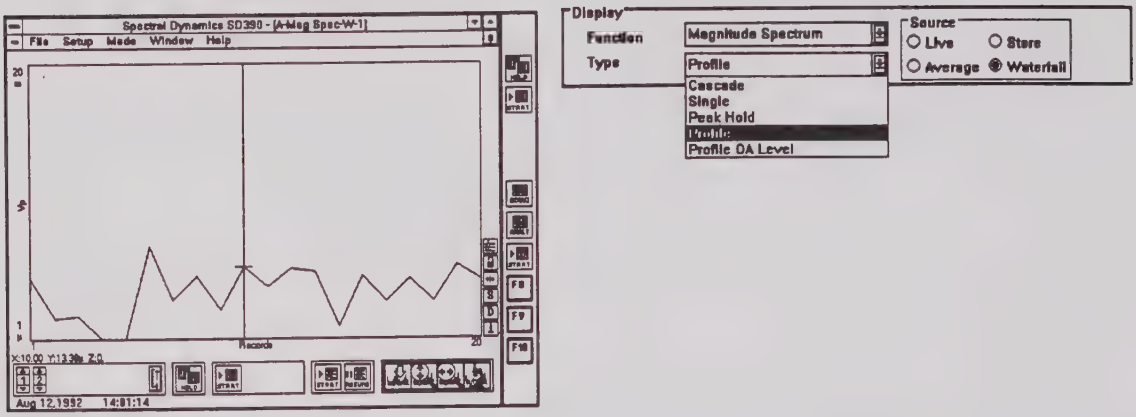
Peak Hold





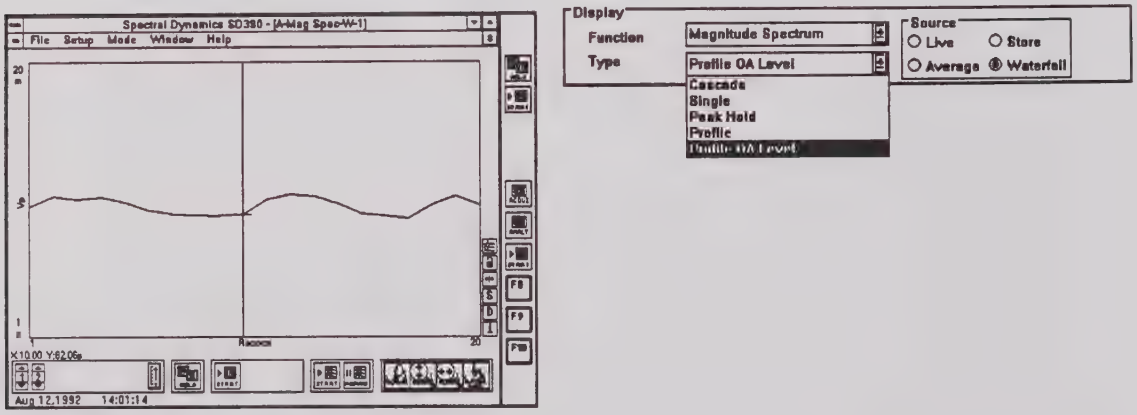
This display is the maximum amplitude at every bin of the collected waterfall data. A range of records can be selected using the Waterfall Record/Profile Selection feature.

Profile



The profile of the waterfall data along any bin (frequency or order) can be displayed by selecting the Profile Display Type. The profile bin and record range are selected using the Waterfall Record/Profile Selection feature.

Profile OA Level

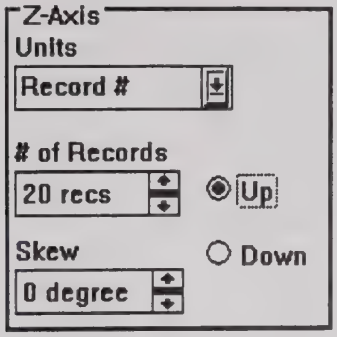


The profile of the Overall Amplitude (rms) Level of each record within the selected range of waterfall data records is displayed by selecting this feature. The range of records is selected using the Waterfall Record/Profile Selection feature.

☞ *Profile displays are not available during Waterfall Load.*

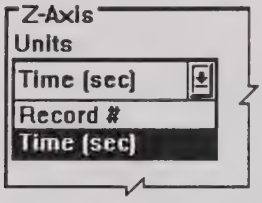
☞ *A minimum of 8 records is required for a Profile Display to be shown.*

Z Axis Group



Parameters for the Z axis can be modified for Cascade and Profile Displays. The z-axis group is used to control the annotation and scaling of the display z-axis.

Units



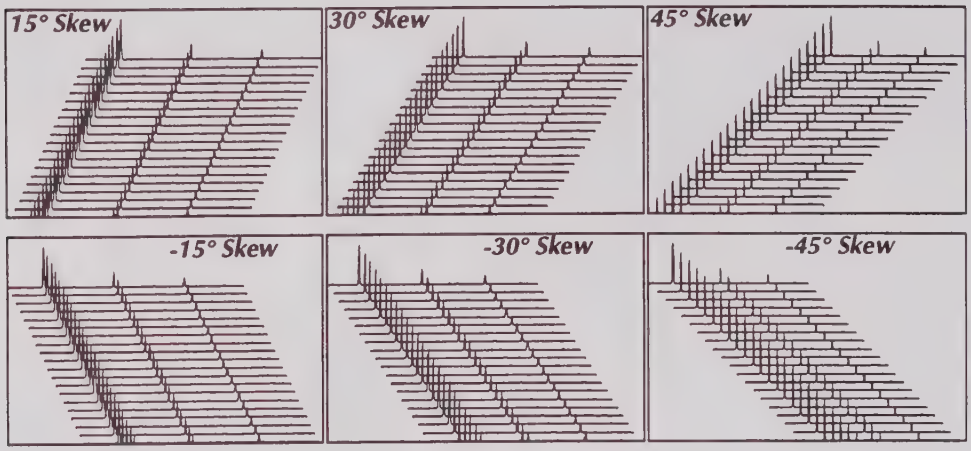
The units combo box allows you to select which units will be used on the z-axis of the display. These units depend upon acquisition and waterfall load options that have been previously selected. The Z axis is always linear. The possible choices are:

- Record Number
- Time
- RPM (when RPM is enable during Acquisition)

Number of Records (Cascade Only)

For Cascade Displays, you can specify the number of records (or traces) to show on one display. The size of the display, the Y Axis Amplitude, and the number of records displayed will each affect the clarity of the individual traces. Fewer traces on a large display will provide the best resolution. The range of data (beginning and ending records) can be specified using the waterfall Record/Profile Selection feature.

Skew (Cascade Only)



Each trace of a Cascade can be offset right or left from the previous trace, with a choice of three levels of skew:

15° - Minimum Skew

30° - More Skew

45° - Most Skew

Left Skew is denoted by a (-) sign.

The skew angle is not exactly 15, 30 or 45 degrees. These numbers are merely indicators of the amount of skew. The skew angle is determined by the size of the display, the number of records and the Y Axis Amplitude, and is adjusted to provide the optimal viewing skew.

Grids and Tic Marks (Profile and Profile OA Only)

Grids and Tic Marks for this axis can be independently selected by choosing the desired options:

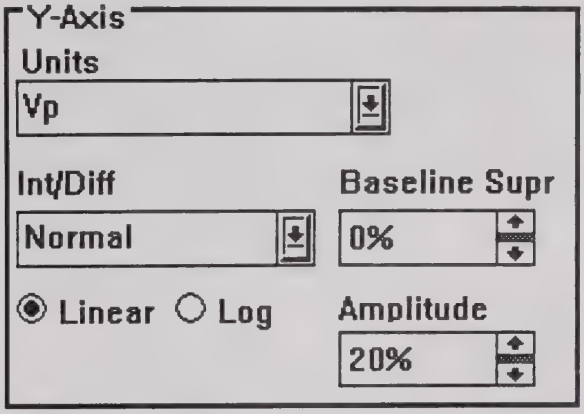
Open - no grids or tic marks; deselect both grid and tic options.

Grids Only - select the grid option.

Tics Only - select the tics option.

Grids and Tics - select both the grid and tic options.

Y Axis Group



There are two additional selections for Y Axis scaling and presentation that are available for Cascade Displays. These selections are:

Amplitude

The Full Scale Amplitude of a single trace relative to the size of the display can be selected from 5% to 50%. The Amplitude of a single trace, in conjunction with the number of displayed records and the display size, will affect the ability to discriminate individual traces of the Cascade Display. A higher amplitude will provide greater resolution of a single trace, but will limit the discrimination among many traces.

BaseLine Suppression

Data below a specified amplitude can be visually suppressed on Cascade Displays. The amplitude is entered in percent Full Scale, from 1% to 99%.

The amount of data suppressed is determined by the size of the display, the number of records displayed and the Y Axis amplitude. The percent of suppression is rounded up to compensate for these parameters. Therefore, more or less suppression can be observed, particularly with small displays or displays with a large number of records.

Whenever a Cascade Display is moved or resized while Waterfall Load is not active, all data in the display is refreshed. During refresh, all controls and options are available. During Waterfall Load, all previously displayed data is erased when the display is moved or resized and new data is added on a fresh display.

When in Octave Mode, the Overall Level is not displayed on cascade displays. It is available, however, on the Overall Profile display.

X and Y Cursor movement is not available on Cascade Displays. A Z axis, or Record cursor, is available. See Cascade Cursor for information on using the Record Cursor.

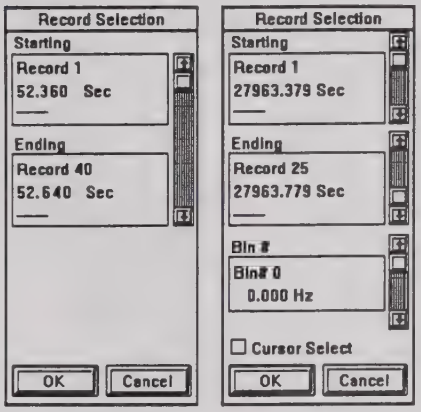
Display expansion and contraction Controls for the X and Y axis can be used for all Waterfall Display Types.

SD390 Hint

For faster Cascade Display updates for playing back data in waterfall memory, place the analyzer in HOLD.

Record/Profile Selection

For the various Waterfall Display Types, the Z Axis range can be selected (or the Profile Bin for Profile Displays) by invoking the Waterfall Record/Profile Select feature.



This feature is selected from the Display Controls pallet by pressing the trackball button when the cursor is over the Waterfall icon . This will present the select dialog, which allows different selections based on the active display type.

Cascade

You can select the starting record (oldest data) and ending record (most recent data), by using the up and down arrows to select the starting record. The ending record is automatically determined by the number of records that are to be displayed for this display. The record numbers, times, and RPM (if RPM is available) are displayed for the starting and ending records.

Single

You can select any individual record from all the acquired waterfall data by using the up and down arrows to select the desired record. The record number, time, and RPM (if RPM is available) is displayed for the selected record.

Peak Hold

You can select the starting record (oldest data) and ending record (most recent data), by using the up and down arrows to select both the starting record and the ending record. The number of records that are to be displayed is not applicable for this display. The record numbers, times, and RPM (if RPM is available) are displayed for the starting and ending records.

Profile

You can select the bin (or line number) that you wish to profile by using the up and down arrows on the bin select, or by using a cursor value from a similar display by checking the "Cursor" check box. When selecting a profile bin, the selected bin number and frequency or order (if SRA is enabled) is displayed. To use a cursor value from a similar display, you must first "Lock" the cursor in the display from which you wish to use the cursor value, then check the "Cursor" checkbox on the Select dialog. See the Locked Cursor description for more information on operating Locked Cursors.

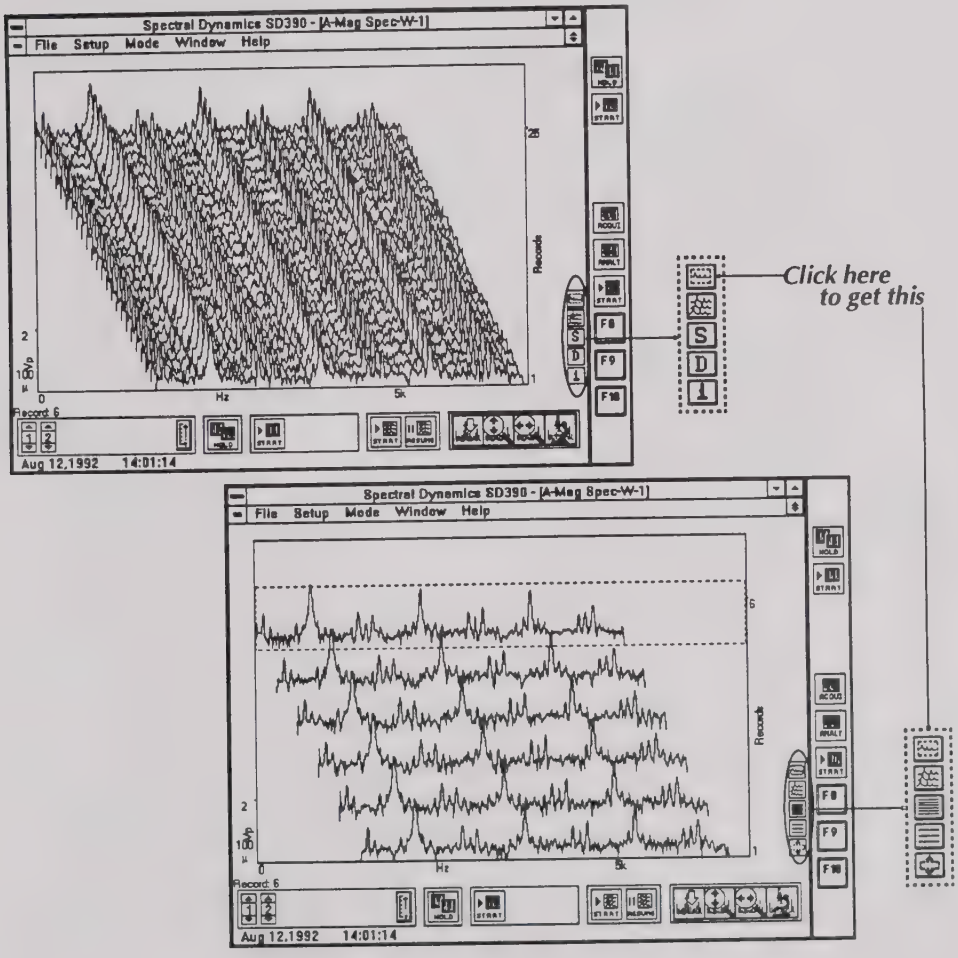
You can also select the starting record (oldest data) and ending record (most recent data), by using the up and down arrows to select both the starting record and the ending record. The number of records that are to be displayed is not applicable for this display. The record numbers, times, and RPM (if RPM is available) are displayed for the starting and ending records.

Profile OA (Overall) Level

You can select the starting record (oldest data) and ending record (most recent data), by using the up and down arrows to select both the starting record and the ending record. The number of records that are to be displayed is not applicable for this display. The record numbers, times, and RPM (if RPM is available) are displayed for the starting and ending records.

Z Axis Display Controls (Cascade Displays Only)

You can graphically zoom in (contract) or pan out (expand) on a selected range of records on waterfall cascade displays by turning on the Z Axis display controls. When the Z axis cursor is enabled, the standard Information, Display and Scale Display Controls are replaced by three Z axis controls.



Select

Clicking on this control allows you to select a record around which you wish to Zoom. The record is highlighted by a dotted rectangle, and the record number is annotated on the left bottom of the display window. You can select a specific record by moving the trackball. Clicking on this control again returns the display controls to their normal state.

The dashed-line rectangle is around the Full Scale amplitude of the selected record, and may appear to contain more than 1 record. The selected record is the record toward the bottom of the rectangle.

Zoom In

Clicking on this control decreases the number of displayed records by a factor of two centered around the selected record. This allows more detail to be shown for each record.

Zoom Out

Clicking on this control increases the number of displayed records by a factor of two centered around the selected record. This allows a better overall view of waterfall memory.

Waterfall Setup Example

The versatility of the Waterfall capabilities in the SD390 allows for dozens of different displays. There are almost as many ways of loading the Waterfall. But all of this begins with 3 simple steps:

- **Enable the Waterfall memory;**
- **Set up the Waterfall parameters, and**
- **Select a Waterfall display**

The following section gives an overview of using these 3 steps.

Enable the Waterfall Memory.

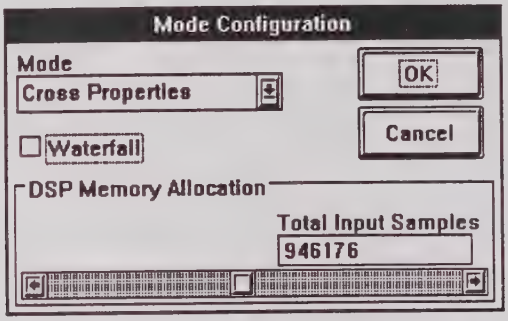
When the Analyzer is first turned on, the display will look like the following figure. Note that a Waterfall display can be shown on a Previously blank screen, such as the following figure, or can be added to existing displays.

Typical SD390 Power-On Default Display

NEXT STEP

➤ Roll the track ball (or external mouse) so that the arrow points at Mode and click once.

The display will appear as shown in the following figure. Keep in mind that the number of Total Input Samples indicated may vary, depending on the size of the DSP memory installed in the analyzer. For this example a 4 MB DSP RAM memory was used.

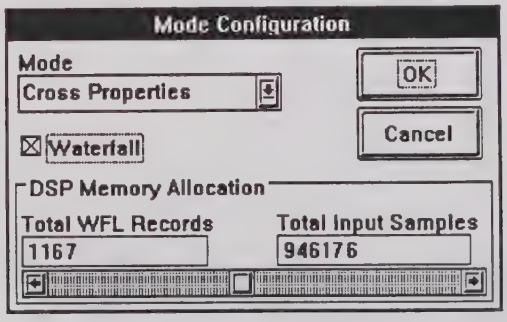


Typical Default Mode Configuration

NEXT STEP

➤ Click on the Waterfall box.

This will create an indication of the total number of Waterfall records available in the analyzer. In addition to the amount of DSP memory installed, this value (Total WFL Records) will vary depending on Mode (Cross Properties etc.) and Block size/number of lines selected. More memory is required to store and display Cross Properties (Transfer Function, Coherence etc.) than to store and display a straight spectrum. Also a 1600 line analysis will require about 8 times as much memory as a corresponding 200 line analysis.



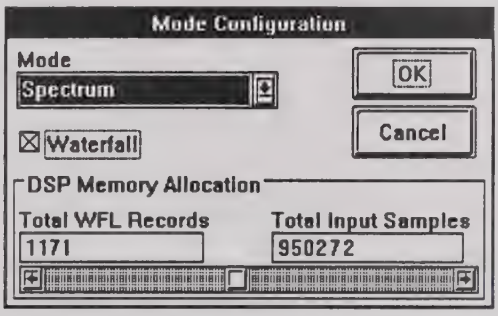
Allocating DSP Memory for Waterfall Displays

Note that the DSP memory is shared between sampled input signals (Total Input Samples) and Waterfall requirements. The left-right scroll bars can be used to apportion the available memory as you see fit.

As you can see from the previous two figures, one of the default conditions on the Mode page is Cross Properties. If you wish, for example, to create a Waterfall display of Transfer Function or Coherence etc. it will be necessary to leave this selection as Cross Properties. For most general Spectrum Waterfall displays however, you will want to change this selection.

NEXT STEP

➤ Place the pointer on the Cross Properties line and click and drag until **Spectrum** is highlighted, then release the trackball. The display will appear as shown in the following Figure.

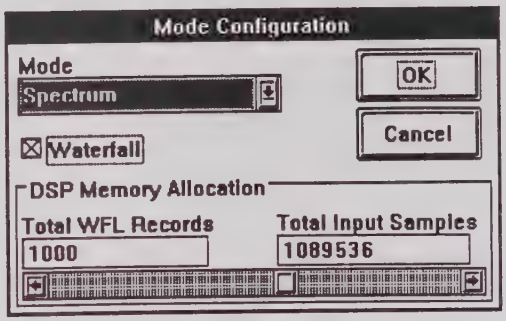


Selecting Spectrum as the Waterfall Mode

NEXT STEP

➤ Drag the horizontal scroll bar left or right to select the desired amount of total Waterfall records that can be stored for this setup.

In this example memory space for 1000 records was allocated. Note that this is the aggregate or total memory allocated for all channels. Thus if 4 channels of Waterfall display were established, each channel could have no more than 250 records in this case.



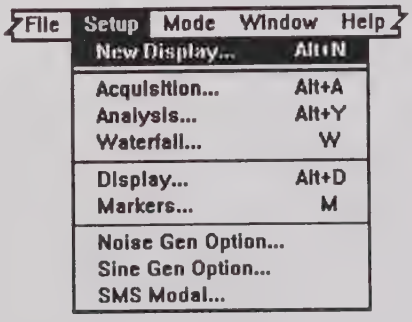
Scrolling Right to Read 1000 Total Waterfall Records

The total number of Waterfall records which can be stored depends on several factors. Among these are the size of the DSP memory, the data type (Cross-Properties, Spectrum, Octave etc.) and the number of spectrum lines per FFT selected. The rate at which records are recorded into the Waterfall also depends on the data type and the number of FFT lines. The fastest transfer will take place with 200 lines and single channel Spectrum selected. This combination will be used here. Click OK.

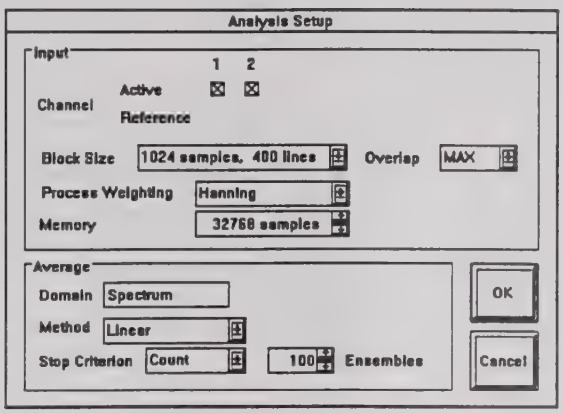
NEXT STEP

➤ Click on Setup, along the top row of the SD390, and click again on Analysis (Alt + Y).

This will bring up the Setup listing shown in the following figure, followed by the Analysis template as shown in the next figure.



Default Listing of Setup Choices

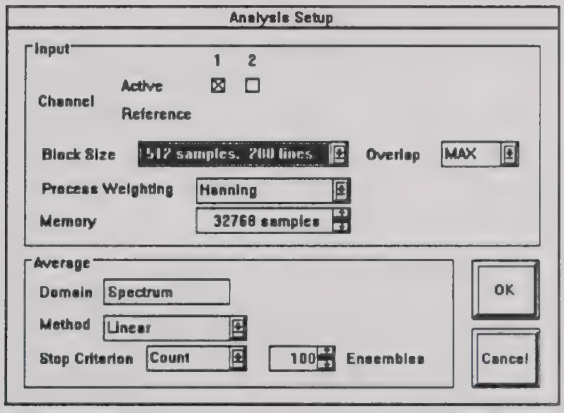


Default Analysis Template for 2-channel Configuration

NEXT STEP

➤ Click on 1024 samples, 400 lines, then click on 512 samples, 200 lines. Click on the Channel 2 box deleting the X. Click OK.

You have now selected a 200 line Spectrum resolution and deactivated all but channel 1. This is shown in the following figure.

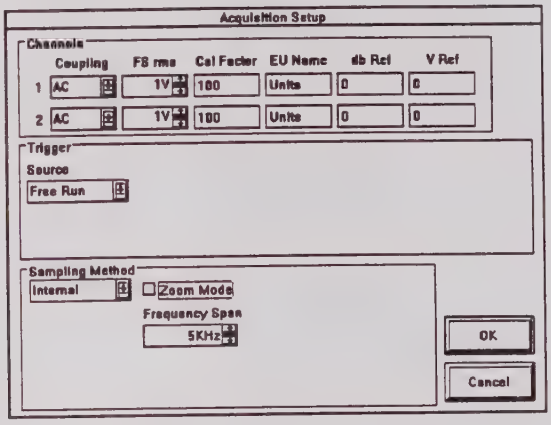


Analysis Template After Selecting 200 Lines & Channel 1 Only

The desired frequency range must now be selected as well as input scaling. This can be done from the front panel or through the Acquisition template.

NEXT STEP

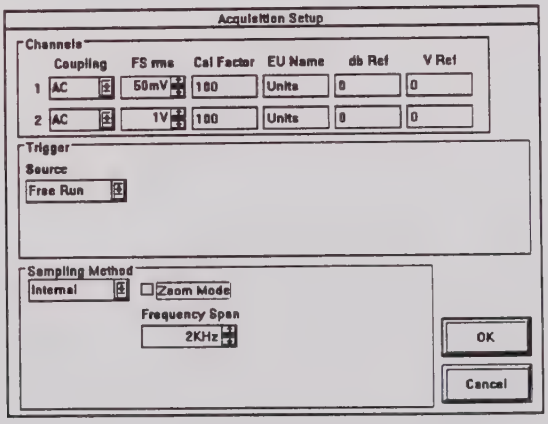
➤ Click on Setup and select Acquisition.



Default Acquisition Template

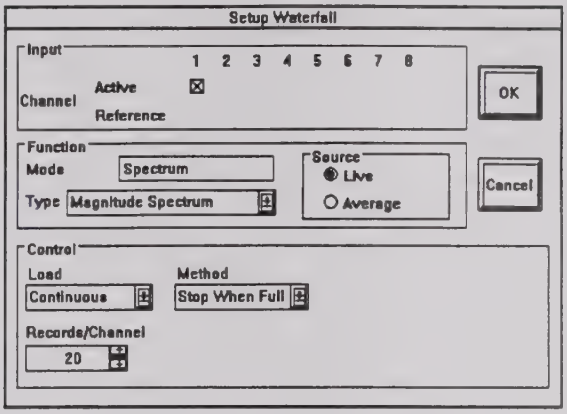
NEXT STEP

➤ Click the Frequency Span down arrow 2 times until it reads 2 kHz, or your desired range. On the top row, for Channel 1, choose the appropriate Coupling and Full Scale. The display should appear as shown in the following figure. Click OK.



Acquisition Template Set Up for This Example

You are now ready to set up the Waterfall parameters in terms of general acquisition. This includes how the Waterfall is to be loaded (continuous, delta time etc.), whether it will be continuous or stopping when full, and how many Records per Channel will be loaded.

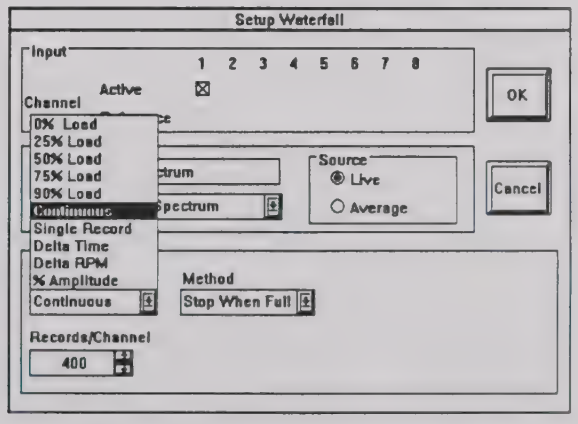


Default Waterfall Setup Template for 1 Active Channel

NEXT STEP

➤ Increase Records/Channel to the desired amount. Select Load and Stop method from the choices presented. Click OK. The display should appear as shown in the following figure.

There are 10 choices given on how the Waterfall will be loaded; 5 direct actions and 5 overlap factors. In the current example Continuous loading will be used. Examples of other loading techniques will be given later.

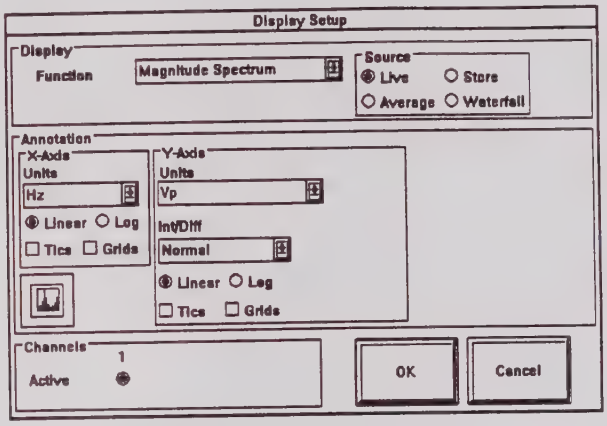


Waterfall Setup Showing Load Selections & 400 Records/Channel

Now that the Waterfall parameters have been established, it is time to select a Waterfall display.

NEXT STEP

➤ If a keyboard is attached to the SD390 simply strike the N key. If not, click on Setup and choose New Display.

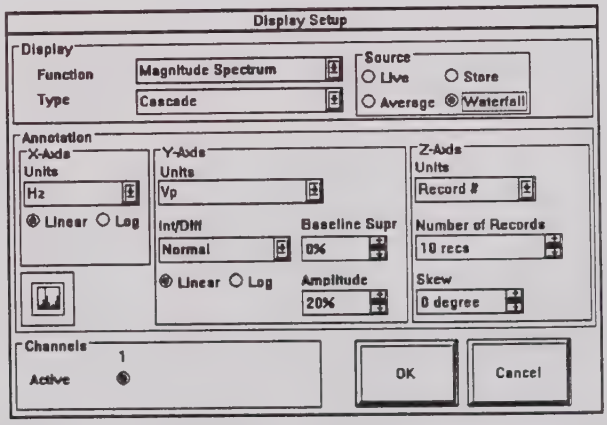


Default Display Setup for 1 Active Channel

The previous figure shows the display choices for Live (real-time), Average or Stored records. You will now choose a Waterfall display.

NEXT STEP

➤ Click on Waterfall Source. A new Z-Axis menu is presented together with 2 new Y-Axis choices and a Display Type selection.

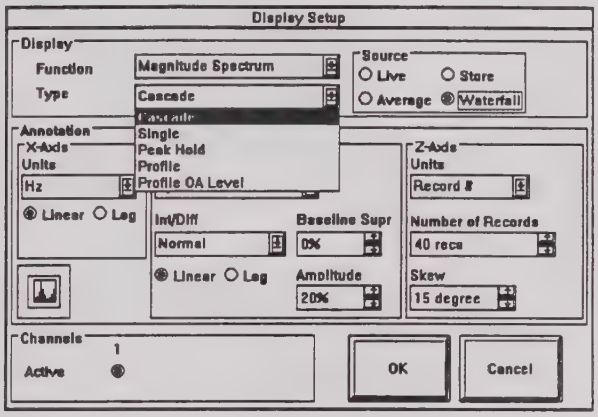


Default Selections for Waterfall Display Setup

The number of records which can be viewed in the waterfall display can vary from 1 to over 100. However, the more records viewed, the smaller the Y-axis display size per record. Typically 40 to 50 records at a time gives a good indication of data dynamics.

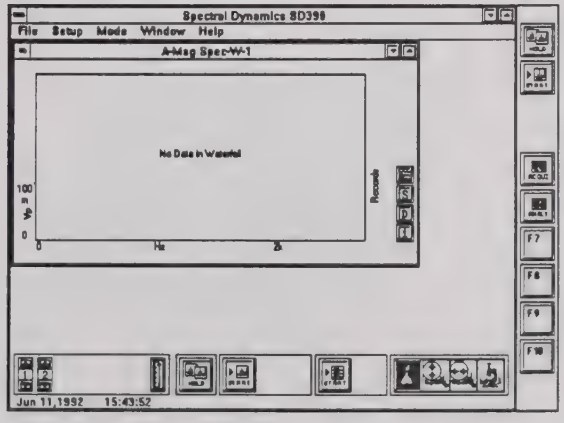
NEXT STEP

➤ Click on the desired Number of Records, Skew, Amplitude, Type, Lin or Log etc. Click OK.



Waterfall Display Setup With Display Type Choices Shown

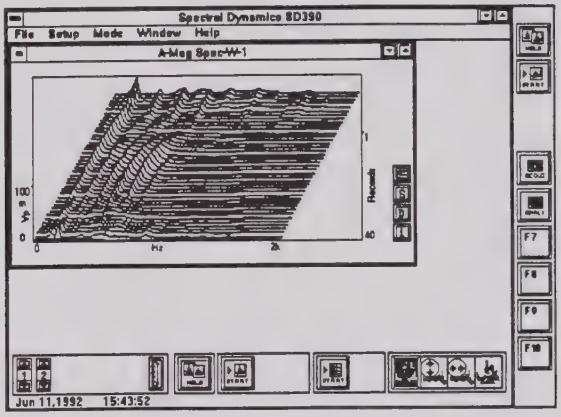
A display will now be presented together with the annotation "No Data in Waterfall." Note that a new START Icon also appears in the bottom row of the display between the Averager and Cursor controls. This is the Waterfall START control.



Initial Waterfall Display Before Data is Stored

NEXT STEP

➤ Prepare data for analysis and click Waterfall START.



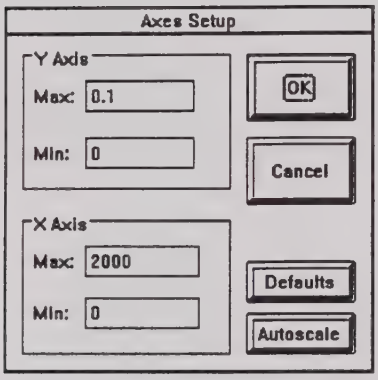
Waterfall Display After 400 Records Were Stored

Scaling the Waterfall Display

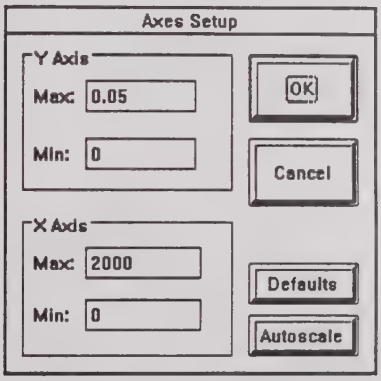
Remember that data stored in the SD390 Waterfall memory is in precision 32-bit floating point format. Thus it can be rescaled after initial display with very little effort. The figures below show the default and rescaled Y-axis parameters for the current Waterfall display.

NEXT STEP

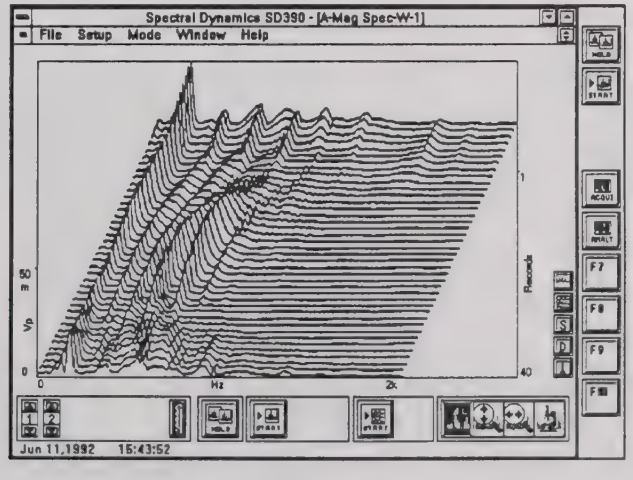
➤ In order to optimize the Waterfall display, click on the S Icon in the Waterfall display "Totem Pole." When the Axes Setup menu appears either click on Auto scale or change the Y Axis Max value to a convenient scale. Click OK.



Default Axes Setup



Optimized Axes Setup



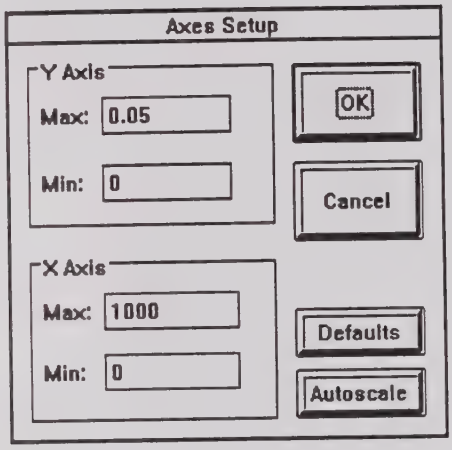
Re-Scaled Waterfall Display Shown Over Whole SD390 Screen

X-axis Scaling

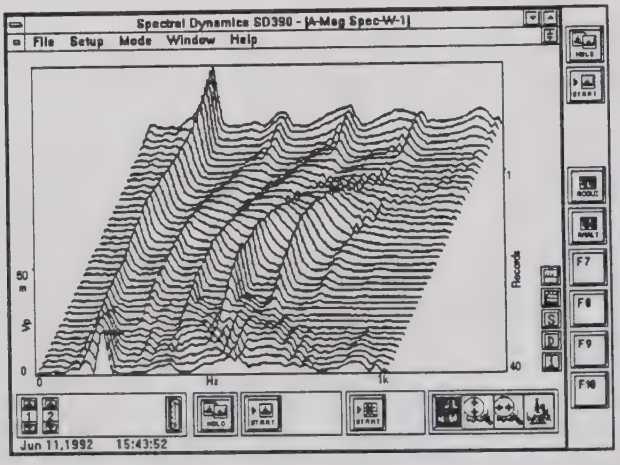
The Waterfall display can also be re-scaled and expanded in the X-axis. Auto scale does not vary the X-axis display, regardless of display content. The maximum X-axis Waterfall display expansion allowable should contain at least 16 FFT bins across the display.

NEXT STEP

➤ Click on the scaling Icon and change the value(s) of X-Axis Min. Max or both. Click OK.



Axes Setup for Expanded X-Axis Display



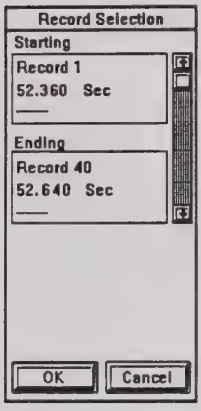
Same Data Scaled 0 to 1,000 Hz

Scrolling Through the Waterfall Memory

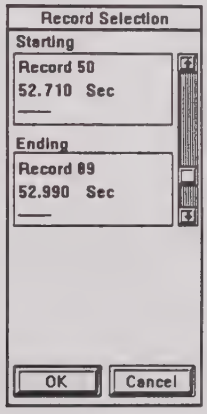
In the current example, we have stored 400 spectrum records in the Waterfall memory, but we are only displaying 40 at a time. If you wanted to change the number of records displayed at one time, there are several ways to do that. One way would be to click on the Display Setup template (Fig. 15) and choose a different number of records such as 33. To scroll vertically through the Waterfall array, however, a different approach is suggested.

NEXT STEP

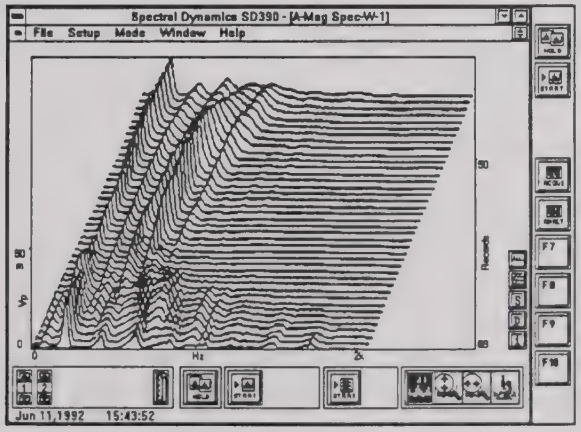
➤ On the "totem pole" at the side of the display click on the Waterfall symbol just above the S Icon. Roll the scroll bar as shown in the following figures until the desired Record Numbers appear.



Default Selection Records 1 - 40



Default Selection Records 50 - 89



Waterfall Display of Records 50 - 89

WATERFALL NOTES

Markers Setup

Markers can be placed on Magnitude Spectrum displays to indicate significant events in the data. Four classes of Markers are available:

➤ **MaxTrax**

The Marker tracks the maximum amplitude of the signal.

➤ **Peaks**

Up to 20 peaks above a specified amplitude threshold can be identified.

➤ **Harmonics**

Up to 20 harmonics can be identified.

➤ **User Defined**

Up to 20 independent Markers can be placed at any frequency.

These markers will identify the amplitude at the specified (or derived) frequency in real time, or can be manipulated when the display is in **HOLD**. The values of these markers plus display identification information can be printed in **List** format to the screen, printer or a file.

When the **Markers** Dialog appears, the **Class** of markers can be selected from a scrolling window. Based upon the **Class**, specific parameters can be selected to identify where to place the markers. New Marker parameters are not used until the **OK** button at the bottom right corner of the dialog is pressed. Selecting **Cancel** causes the dialog to disappear without modifying the existing parameters.

How to Invoke

When the Active Window's Display Type is **Magnitude Spectrum**, Markers can be placed on the display by invoking the Marker Setup Dialog.

To invoke the Markers Setup Dialog for the Active Window to set specific Marker parameters:

➤ **Use the trackball to:**

Select the **Setup** Menu

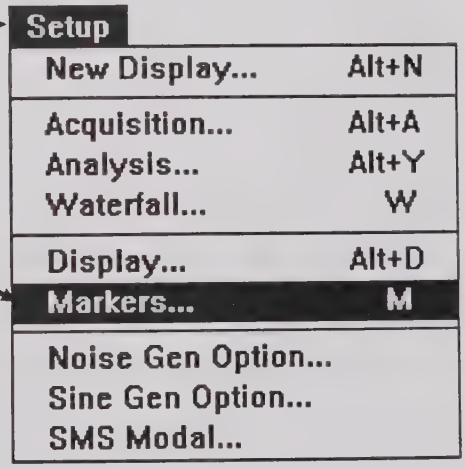
and then

➤ **Select Markers**

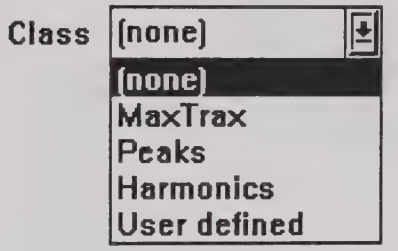
or

Use The Keyboard and

➤ **Press The "M" Key.**



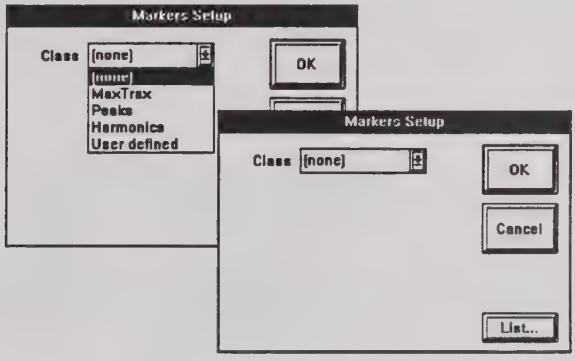
Class



The Class of Markers defines the type of marker to be displayed. The selections are:

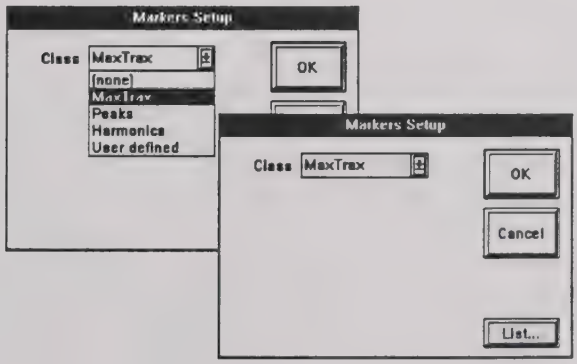
None

The Markers are disabled.

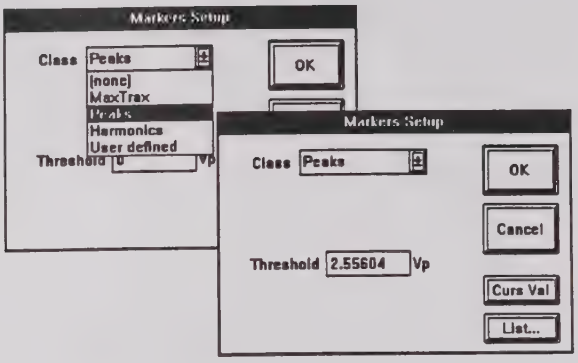


MaxTrax

The Marker tracks the maximum amplitude of the signal.

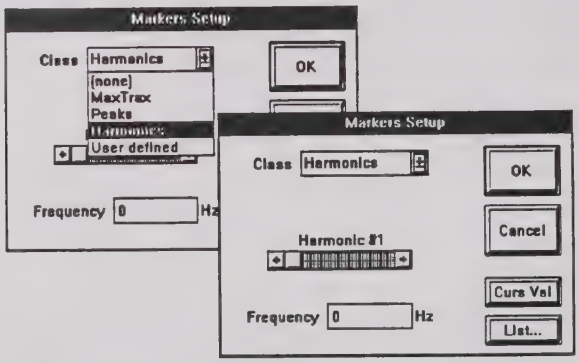


Peaks



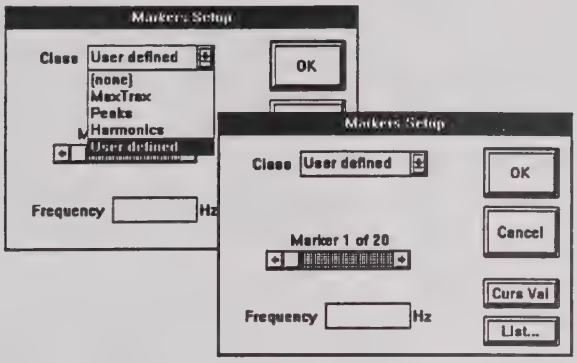
Up to 20 peaks above a specified amplitude threshold can be identified. The threshold can be entered into the Threshold field by typing the desired amplitude value, or automatically entering the amplitude value from the Cursor Value field. The number of peaks above the given threshold (up to a maximum of 20) will be calculated and displayed.

Harmonics



Up to 20 harmonics can be identified by specifying a desired harmonic number and the frequency at that harmonic. Using these two parameters, all other harmonics within the range are calculated and displayed. It is not necessary to identify the first harmonic from which all other harmonics are calculated. In fact, more accuracy can be obtained by selecting a dominant harmonic, and relating all other harmonics to the dominant harmonic. Selecting the desired "key" harmonic is accomplished by sliding the Harmonic Number slide bar from 1 to 20. You can then enter the corresponding frequency value in the Frequency field by typing the value, or automatically entering the frequency value from the Cursor Value field.

User Defined



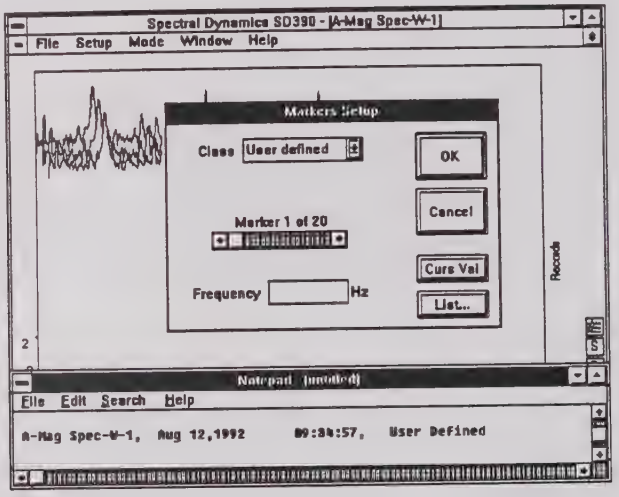
Up to 20 independent Markers can be placed at any frequency by specifying the marker number and frequency at which to place the marker. The marker number is selected by sliding the Marker Number slidebar from 1 to 20. You can then enter the corresponding frequency value in the Frequency field by typing the value, or automatically entering the frequency value from the Cursor Value field. To erase a displayed marker, enter a frequency value of 0.

Curs Val

When this option appears, the parameter value for the Marker can be obtained from the Cursor position in the display. Clicking on the Cursor Value button will place the cursor frequency or threshold in the Markers Frequency Value field.

List

Clicking on the List Button will cause the displayed markers to be listed in tabular format to the Windows NotePad. The frequency and amplitude of each Marker is written to the NotePad, along with Active Window information of the display. Each time you List Markers, the information is appended to the list in the NotePad. You can then use the NotePad File features to save the information in a named file, or to print the information to the attached printer. Other NotePad options are available for editing the information or adding more annotation or notes.



The first time the Markers are listed to the NotePad, the NotePad Window will cover the lower part of the main SD390 Window. When you return to the SD390 Window the NotePad will be buried, but listings will still be written to the NotePad. If you wish to see the listings as they are generated, you can resize the main SD390 window and NotePad window to suit your viewing needs.

Open/Save Configuration

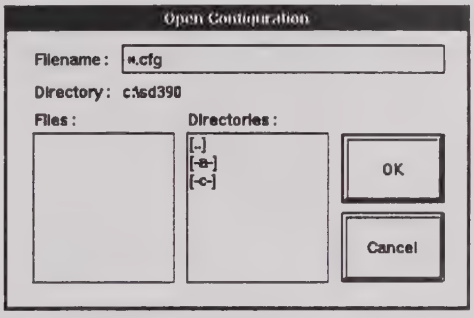
There are two Dialogs that allow you to Restore and Save SD390 operating configurations.

➤ **Open Configuration**

➤ **Save Configuration**

These options are accessed from the File Menu. Open and Save Configuration prompt you for named files which contain the configuration information.

Open Configuration



The wildcard file name template is displayed in the **Filename** entry box, which causes a list of current configuration files to be displayed in the **Files** box. All configuration files have the default extension, **.CFG**. You can select one of the existing configuration files by selecting a file in the **Files** box, then pressing **OK.**

If you have saved a configuration file with a different extension than **.CFG**, you can modify the wildcard search, or directly enter the desired filename in the **Filename** entry box by:

➤ Double clicking in the **Filename** entry box to invoke the Virtual Keyboard

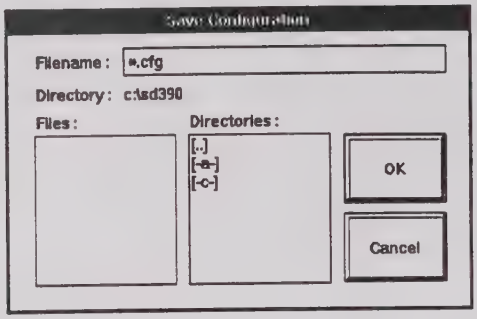
or

➤ Enter the filename from an optional keyboard.

The disk drive and directory from which the file will be read can also be changed by selecting the desired drive and directory from the **Directories** entry box.

☞ *This operation can be canceled by clicking on the* ***Cancel*** *button.*

Save Configuration



The wildcard file name template is displayed in the **Filename** entry box which causes a list of current configuration files to be displayed in the **Files** box. All configuration files have the standard default extension, **.CFG**. You can select an existing file to save the current configuration by selecting a file in the **Files** box, then pressing **OK**. You will then be reminded that the configuration previously stored in the existing file will be replaced by the new configuration, and have the chance to cancel the operation.

You can modify the wildcard search, or directly enter the desired filename in the **Filename** entry box by:

➤ Double clicking in the **Filename** entry box to invoke the Virtual Keyboard

or

➤ Enter the filename from an optional keyboard.

Be sure to enter the **.CFG** extension as part of the filename, if you want to retain the standard extension.

The disk drive and directory to which the file will be saved can also be changed by selecting the desired drive and directory from the **Directories** entry box.

☞ *This operation can be canceled by clicking on the* **Cancel** *button.*

SD390 Hint

For more information on wild cards, disks, directories, and files, see the Microsoft Windows Users Guide provided with this system.

Open/Save/Export Data

There are three Dialogs which allow you to Restore, Save, and Export data.

➤ **Open Data**

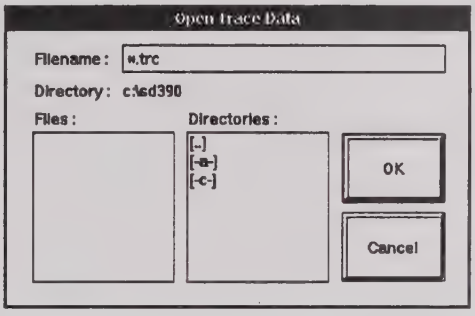
➤ **Save Data**

➤ **Export Data**

Save and Restore are internal functions. Export allows transferring data to other applications and/or other systems.

These options are accessed from the File Menu. Each function prompts you for named files which contain the data.

Open Data



The wildcard file name template is displayed in the **Filename** entry box, which causes a list of current data files to be displayed in the **Files** box. All data files have the default extension, **.TRC**. You can select one of the existing data files by selecting a file in the **Files** box, then pressing **OK**.

If you have saved a data file with a different extension than **.TRC**, you can modify the wildcard search, or directly enter the desired filename in the **Filename** entry box by:

➤ Double clicking in the **Filename** entry box to invoke the Virtual Keyboard,

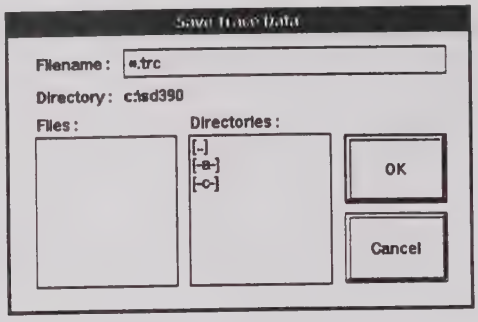
or

➤ Enter the filename from an optional keyboard.

The disk drive and directory from which the file will be read can also be changed by selecting the desired drive and directory from the **Directories** entry box.

☞ *This operation can be canceled by clicking on the* ***Cancel*** *button.*

Save Data



The wildcard file name template is displayed in the **Filename** entry box, which causes a list of current data files to be displayed played in the **Files** box. All data files have the standard default extension, **.TRC**. You can select an existing file to save the current data by selecting a file in the **Files** box, then pressing **OK**. You will then be reminded that the data previously stored in the existing file will be replaced by the new data, and have the chance to cancel the operation.

You can modify the wildcard search, or directly enter the desired filename in the **Filename** entry box by:

➤ Double clicking in the **Filename** entry box to invoke the Virtual Keyboard,

or

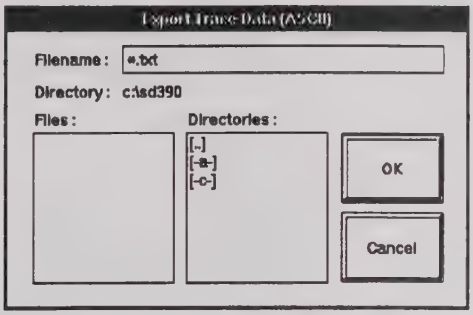
➤ Enter the filename from an optional keyboard.

Be sure to enter the **.TRC** extension as part of the filename, if you want to retain the standard extension.

The disk drive and directory to which the file will be saved can also be changed by selecting the desired drive and directory from the **Directories** entry box.

☞ *This operation can be canceled by clicking on the **Cancel** button.*

Export Data



The wildcard file name template is displayed in the **Filename** entry box, which causes a list of current export files to be displayed in the **Files** box. All export files have the default extension, **.TXT**. You can select one of the existing data files by selecting a file in the **Files** box, then pressing **OK**.

If you have saved an export file with a different extension than **.TXT**, you can modify the wildcard search, or directly enter the desired filename in the **Filename** entry box by:

➤ Double clicking in the **Filename** entry box to invoke the Virtual Keyboard,

or

➤ Enter the filename from an optional keyboard.

The disk drive and directory from which the file will be read can also be changed by selecting the desired drive and directory from the **Directories** entry box.

☞ *This operation can be canceled by clicking on the* **Cancel** *button.*

☞ *The removable floppy diskette is drive* **A:** *and can be used for transporting Export files to other systems.*

SD390 Hint

For more information on wild cards, disks, directories, and files, see the Microsoft Windows Users Guide provided with this system.

Load/Save Extended Memory

There are two Dialogs which allow you to Save and Restore data from/to the SD390's Extended Recorder Memory:

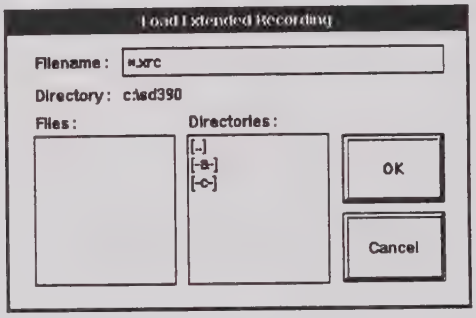
➤ **Load Extended Rec**

➤ **Save Extended Rec**

These options are accessed from the File Menu. You are prompted to supply named files which contain the Extended Recorder Memory data.

The number of files that can be saved is limited by the available disk storage.

Load Extended Rec



The wildcard file name template is displayed in the **Filename** entry box, which causes a list of current XRec data files to be displayed in the **Files** box. All XRec data files have the default extension, **.XRC**.

You can select one of the existing XRec data files by selecting a file in the **Files** box, then pressing **OK**.

If you have saved a XRec data file with a different extension than **.XRC**, you can modify the wildcard search, or directly enter the desired filename in the **Filename** entry box by:

➤ Double clicking in the **Filename** entry box to invoke the Virtual Keyboard,

or

➤ Enter the filename from an optional keyboard.

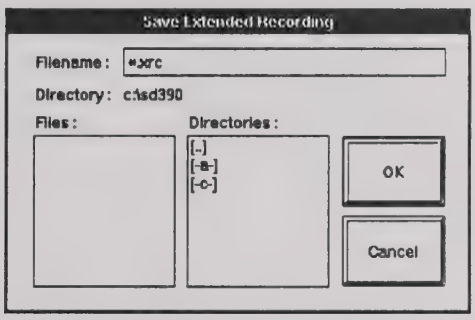
The disk drive and directory from which the file will be read can also be changed by selecting the desired drive and directory from the **Directories** entry box.

☞ *This operation can be canceled by clicking on the* **Cancel** *button.*

It is recommended that the **.cfg** file that was manually saved when the corresponding **.xrc** file was saved, be recalled *prior* to recalling the **.xrc** file. This will ensure proper analyzer display setup for the recalled **.xrc** file (see the NOTE under **Save Extended Rec**).

Data from an Extended Rec disk file can be loaded at any time. However, all current data, Acquisition and Analysis Parameters are replaced by the saved data and saved parameters. These parameters may not be compatible with the current settings, and may invalidate the current Averager and Displays. Therefore, it's good practice to stop Acquisition before Loading this data, although this function will automatically stop Acquisition (and Averaging) if active. Parameters that were in effect when the data was saved are also loaded at this time.

Save Extended Rec



The wildcard file name template is displayed in the **Filename** entry box, which causes a list of current XRec data files to be displayed in the **Files** box. All XRec data files have the standard default extension, **.XRC**. You can select an existing file to save the current Extended Recorder Memory data by selecting a file in the Files box, then pressing **OK**. You will then be reminded that the data previously stored in the existing file will be replaced by the new data, and have the chance to cancel the operation.

You can modify the wildcard search, or directly enter the desired filename in the **Filename** entry box by:

➤ Double clicking in the **Filename** entry box to invoke the Virtual Keyboard,

or

➤ Enter the filename from an optional keyboard.

Be sure to enter the **.XRC** extension as part of the filename, if you want to retain the standard extension.

The disk drive and directory to which the file will be saved can also be changed by selecting the desired drive and directory from the **Directories** entry box.

This operation can be canceled by clicking on the **Cancel** button.

Storing 8 channels of Extended Recorder data takes 1.5 minutes and uses 524,690 bytes of disk storage. On a 1.44MB removable diskette, there is space for two 8 channel files.

To streamline the recall of saved **.xrc** files, it is strongly recommended that a configuration file be saved along with the **Save Extended Rec** data file. Use the same file name with **.cfg** appended under the Save Configuration File.

Because **Save Extended Rec** is a global command that affects more than the "hot" compressed trace window, you should recall the **.cfg** file before recalling the **Load .xrc** file to ensure proper analyzer display setup for the recalled **.xrc** file.

SD390 Hint

For more information on wild cards, disks, directories, and files, see the Microsoft Windows Users Guide provided with this system.

Load/Save Waterfall Memory

There are two Dialogs which allow you to Save and Restore data from/to the SD390's Waterfall Memory:

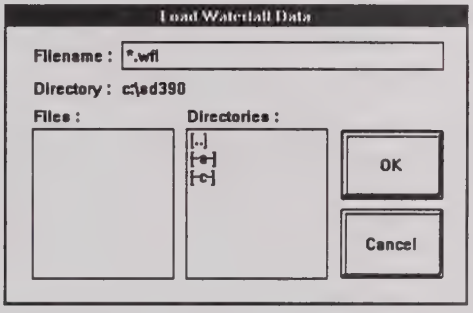
➤ **Load Waterfall Data**

➤ **Save Waterfall Data**

These options are accessed from the File Menu. You are prompted to supply named files which contain the Waterfall Memory data.

The number of files that can be saved is limited by the available disk storage.

Load Waterfall Data



The wildcard file name template is displayed in the **Filename** entry box, which causes a list of current Waterfall data files to be displayed in the **Files** box. All Waterfall data files have the default extension, **.WFL**. You can select one of the existing Waterfall data files by selecting a file in the **Files** box, then pressing **OK**.

If you have saved a Waterfall data file with a different extension than **.WFL**, you can modify the wildcard search, or directly enter the desired filename in the **Filename** entry box by:

➤ Double clicking in the **Filename** entry box to invoke the Virtual Keyboard,

or

➤ Enter the filename from an optional keyboard.

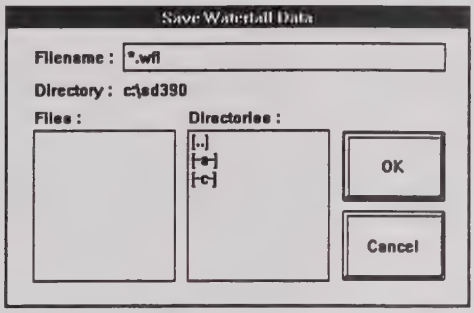
The disk drive and directory from which the file will be read can also be changed by selecting the desired drive and directory from the **Directories** entry box.

☞ *This operation can be canceled by clicking on the* **Cancel** *button.*

It is recommended that the **.cfg** file that was manually saved when the corresponding **.wfl** file was saved, be recalled *prior* to recalling the **.wfl** file. This will ensure proper analyzer display setup for the recalled **.wfl** file (see the NOTE under **Save Waterfall Data**).

Data from a Waterfall data disk file can be loaded at any time. However, all current data and Acquisition and Analysis Parameters are replaced by the saved data and saved parameters. These parameters may not be compatible with the current settings, and may invalidate the current Averager, and/or Waterfall Memory and associated displays. Therefore, it's good practice to stop Acquisition before Loading this data, although this function will automatically stop all acquisition functions if active.

Save Waterfall Data



The wildcard file name template is displayed in the **Filename** entry box, which causes a list of current Waterfall data files to be displayed in the **Files** box. All Waterfall data files have the standard default extension, **.WFL**. You can select an existing file to save the current Waterfall Memory data by selecting a file in the **Files** box, then pressing **OK**.

You will then be reminded that the data previously stored in the existing file will be replaced by the new data, and have the chance to cancel the operation.

You can modify the wildcard search, or directly enter the desired filename in the **Filename** entry box by:

➤ Double clicking in the **Filename** entry box to invoke the Virtual Keyboard,

or

➤ Enter the filename from an optional keyboard.

Be sure to enter the **.WFL** extension as part of the filename if you want to retain the standard extension.

The disk drive and directory to which the file will be saved can also be changed by selecting the desired drive and directory from the **Directories** entry box.

☞ *This operation can be canceled by clicking on the* **Cancel** *button.*

SD390 Hint

For more information on wild cards, disks, directories, and files, see the Microsoft Windows Users Guide provided with this system.

It is recommended that the **.cfg** file that was manually saved when the corresponding **.wfl** file was saved, be recalled *prior* to recalling the **.wfl** file. This will ensure proper analyzer display setup for the recalled **.wfl** file (see the NOTE under **Save Waterfall Data**).

Data from a Waterfall data disk file can be loaded at any time. However, all current data and Acquisition and Analysis Parameters are replaced by the saved data and saved parameters. These parameters may not be compatible with the current settings, and may invalidate the current Averager, and/or Waterfall Memory and associated displays. Therefore, it's good practice to stop Acquisition before Loading this data, although this function will automatically stop all acquisition functions if active.

Section 5 - Display Windows

Description

Display windows are used to display traces. In addition to displaying the trace, they also display information about the type of trace, the channels involved in the trace and the X- and Y-axis units. Display windows also have a built-in Standard Cursor mechanism that can be used to display the value of a trace at a particular point or spectral line, in the case of a spectrum trace.

Display windows can be individually manipulated (moved and resized) or grouped together (cascaded or tiled). They can be iconized (shrunk to a small picture) temporarily to reduce screen clutter or maximized to fill most of the screen.

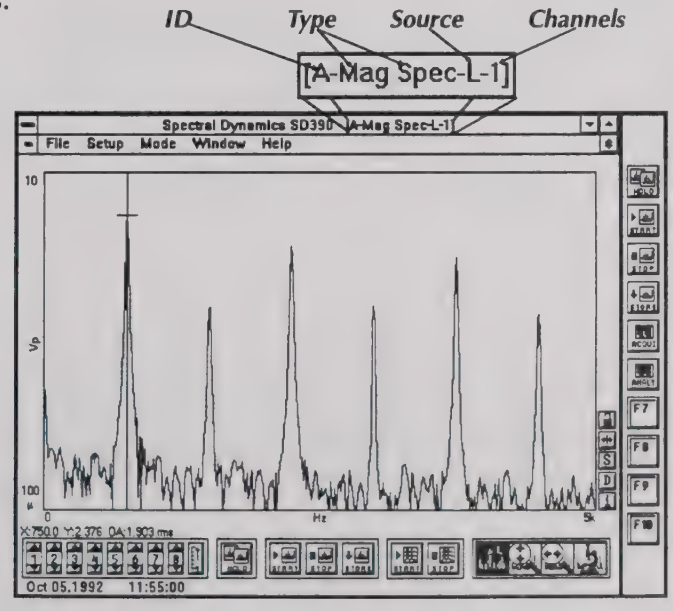
In most circumstances, data is being processed in accordance with the specified Analysis parameters even if it is not being displayed.

Features

Every Display Window has certain features that provide you with important information about the trace being displayed.

Title

The title for each Display Window appears in the window title bar. The format for each Display Window title consists of four fields, separated by hyphens as follows:



ID

A single letter from A to I, assigned automatically and unique (only one Display Window has an ID letter "A," for example).

Type

An abbreviation of the trace type, as specified in the Display Setup Dialog when the display was created or last modified.

Source

The trace source can be any one of the following . . .

- **L - Live**
- **A - Average**
- **S - Store**
- **W - Waterfall**
- **F - Recalled Disk File**

. . . as specified in the Display Setup Dialog when the display was created or last modified.

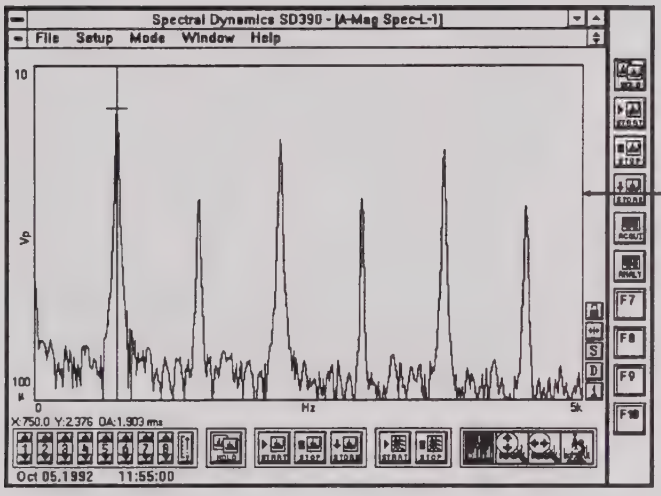
Channels

The channels involved in the trace as specified in the Display Setup Dialog when the display was created or last modified. Either a single channel number (e.g. 1) or a channel/reference pair (e.g. 2/1) depending on the display type.

The background color of the Title bar indicates whether the display is an active window. There is only one active window at a time.

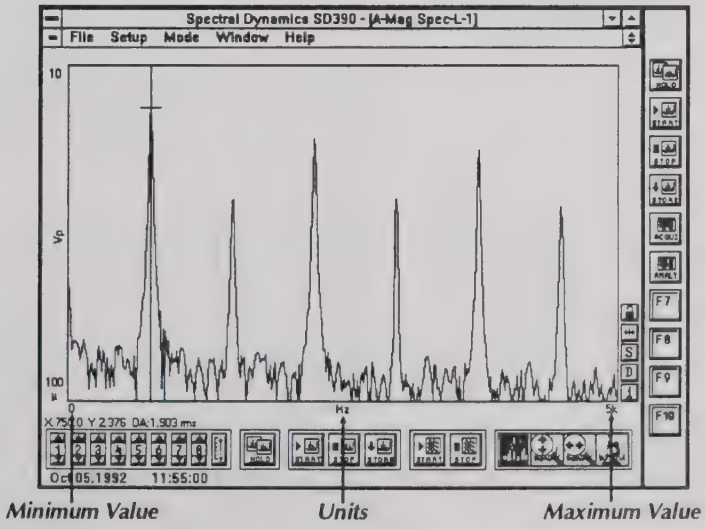
Trace Rectangle

The trace rectangle serves as a frame for the trace, which is displayed horizontally within the trace rectangle.



X-Axis Annotation

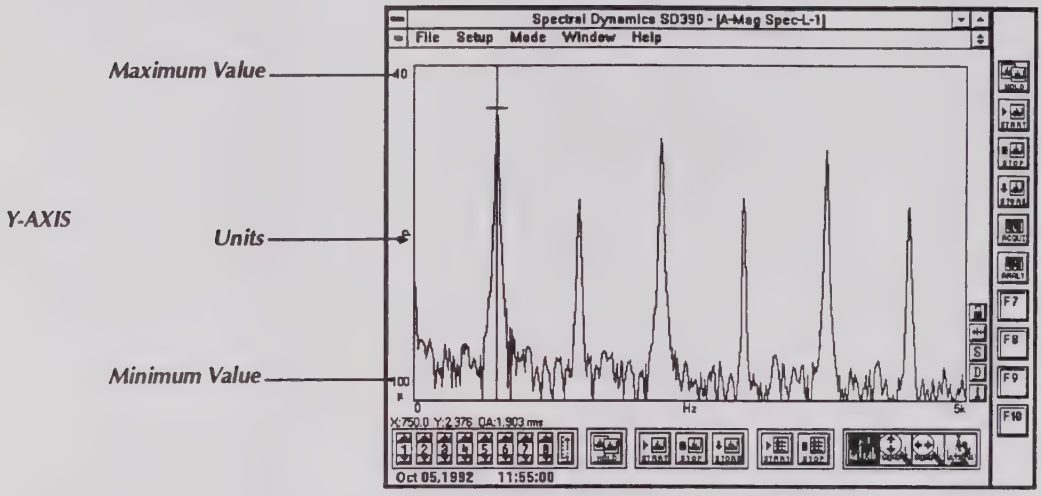
The X-axis units, minimum value, and maximum value are written at the bottom of the trace rectangle. Values are expressed in exponential notation.



X-AXIS

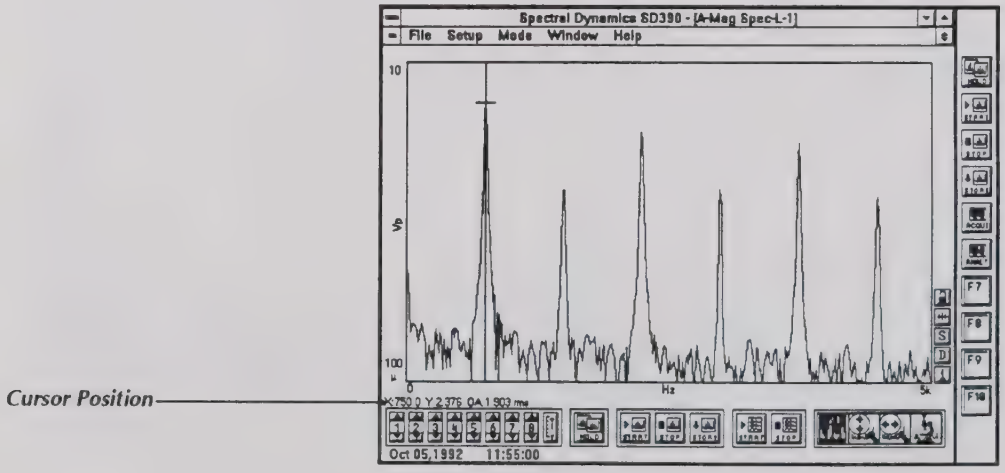
Y-Axis Annotation

The Y-axis units, minimum value, and maximum value are written at the left side of the trace rectangle.



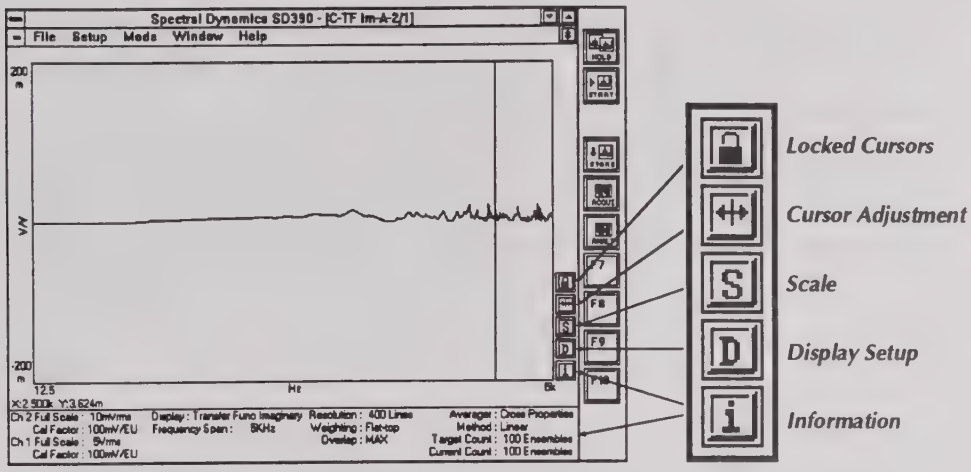
Cursor Position

The cursor position refers to the coordinates of the trace point/line intersecting the cursor symbol and is displayed at the bottom left hand corner of the Display Window. Typically, the X and Y axis values, plus the overall (OA) level in the selected axis units are displayed for cursor readout. For Orbit displays, time is displayed as the third cursor value. For Nyquist displays, frequency is displayed as the third cursor value. For Octave displays, the octave band and overall level are displayed as the third and fourth cursor values, respectively.



Display Controls

There are five Display Controls available for all Display Windows:



➤ **Locked Cursors**

With more than one display on the screen, this selection will invoke simultaneous cursor movement on *like-domain* multiple displays. When this icon is selected the *active* display will become the master in a master-slave relationship.

➤ **Cursor adjustment**

Hides the *display cursor arrow* and allows movement of the *data cursor* using the trackball.

➤ **Scale**

Invokes the **Axes Setup** menu for the *current* display.

➤ **Display Setup**

Invokes the **Display Setup** menu for the *current* display.

➤ **Information**

With the display cursor arrow on this icon and the trackball button held down, display information will appear at the bottom of the display as shown in the previous example.

For Compressed Time Displays, there is an additional Limits Control when the SD390 is in HOLD and data is available in the Extended Recorder Memory for Playback. For Waterfall Displays, a Waterfall Record/Profile Selection control is available. For Waterfall Cascade Displays, Z Axis Controls are also available.

☞ *Depending upon the size of the display, all or some of these controls may be visible.*

How To Create

Display windows are created by using the New Display command in the Setup menu.

The SD390 allows up to 9 Display Windows. After 9 displays have been created, you cannot create more without first disposing of some of the existing Display Windows (see How To Remove, later in this section).

Before discussing modification and removal of Display Windows, it is necessary to introduce the concept of the active Display Window.

The Active Display Window

There is always a "privileged" Display Window at all times, unless there are no Display Windows at all. This window is called the *active* Display Window. Any Display Window may be made active by clicking anywhere on it with the trackball cursor. The active Display Window can be distinguished from other Display Windows by its highlighted title bar and is always completely visible ("on top of") all the other Display Windows.

How To Remove

There are a variety of methods for removing the active display window. Two that use only the trackball are:

Click on the control-menu box located in the upper left-hand corner of the Display Window (the active display window is the only one with a control-menu box). Choose Close. . .

or

. . . double click on the control-menu box.

How To Modify

The settings for the active Display Window can be changed using the New Display command in the Setup menu. When this command is issued, the Display Setup Dialog is invoked with all parameters defaulted to the current settings for the active Display Window. When the values in the dialog are changed and the OK button is clicked, the settings for the active Display Window are updated and the display window immediately changes to reflect the new settings.

How To Iconize

It is sometimes desirable to get a Display Window "out of the way" without removing it. This can be done by iconizing it (changing it to an icon, or picture object, which resides near the bottom of the screen). The icon is labeled with the same title as the original display window so it can be restored later.

To iconize a Display Window, click in the minimize box located in the upper right-hand corner of the *active* Display Window. You may need to retile the other Display Windows (using the Tile command under the Window Menu or move them around in order to see the new Display Window icon. To restore an iconized Display Window to its original size and location, double click on its icon.

How To Maximize

It is also sometimes desirable to make a Display Window as large as possible in order to inspect finer trace details. This can be done by maximizing it. When a Display Window is maximized, it fills up most of the screen and hides all other Display Windows, including iconized Display Windows.

To maximize a Display Window, click in the maximize box located in the upper right-hand corner of the Display Window. You will note that the Display Window "disappears" and that its contents now fill up the entire frame window. In addition, the title of the Display Window is appended to the frame window title and a new icon appears at the right hand side of the Main Menu bar. This is the restore icon. Clicking on it restores the Display Window to its original size and location.

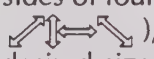
How To Group

Display windows can also be organized as a group using the Window Menu options: Tiles, and Cascade. See that section for details on grouping Display Windows.

How To Move

Display windows can be moved independent of one another by clicking and holding on their title bars, then dragging the outline of the Display Window to the desired position. You cannot drag a display window outside the boundaries of the frame window.

How To Resize

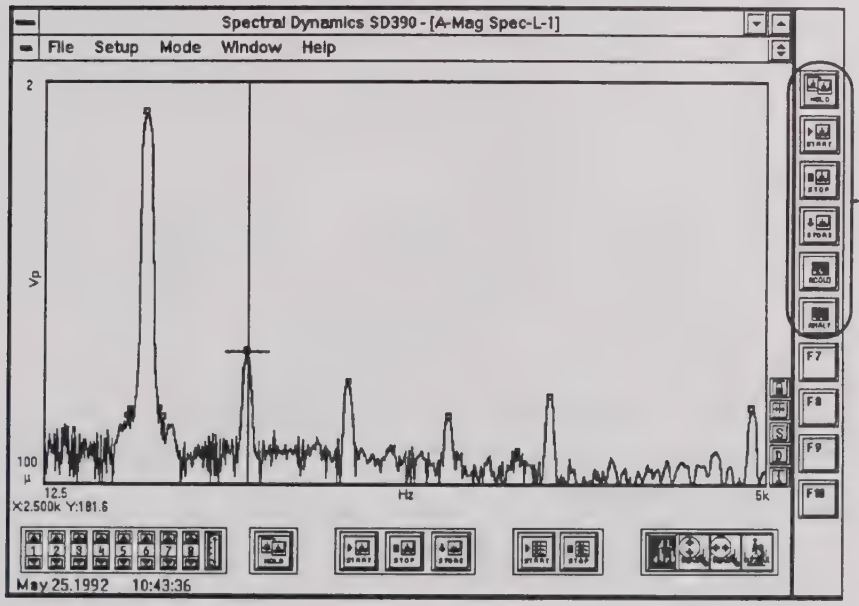
Display windows can be resized by clicking and holding on one of their four sides or four corners (the cursor will change into one of the following arrows ), and dragging in the direction of the cursor until the outline is the desired size. When the trackball button is released, the Display Window will expand or contract to the size of the outline.

Display windows have a minimum allowable size and cannot be made smaller than this size using the resizing cursors. If an attempt is made to make the Display Window smaller than this minimum size, the Display Window will "bounce back" to the minimum size.

Section 6 - Function Key Area

Function Key Controls

There are 6 controls located in the Function Key Area. These keys are duplicates of controls located in the Control Area and are "short-cuts" to the Acquisition Parameters and Analysis parameters. You can click on the control in the Function Key Area just as if it were the control in the Control Area or a Menu selection.



Physical Function Buttons

To the right of each control in the Function Key Area is a physical button, located next to the SD390 screen. Pushing the button next to a control is equivalent to clicking on the control itself, or invoking the selected dialog.

Keyboard Function Keys

If you have the SD390 keyboard option, the controls in the Function Key Area can also be activated by using the keyboard function keys (F1-F6). F1 corresponds to the uppermost function key control while F4 corresponds to the lowest. F5 and F6 invoke the Acquisition and Analysis dialogs, respectively.

The keyboard function keys are only active when the main SD390 window is active. If the function keys do not respond, ensure that the SD390 Title Bar is highlighted (located above the Main Menu), indicating that the main window is active. To make the SD390 main window active, click on the SD390 title bar.

Summary

To perform one of the functions specified by the function keys, you can either:

- **Click** on the control in the Control Area or,
- **Click** on the control in the Function Key Area,
- **Press** the physical button next to the function key to invoke one of the following functions:

  Input Memory Update/Hold

  Averager Start

  Averager Stop/Resume/Single

  Averager Store

  Acquisition Dialog

  Analysis Dialog

Section 7 - Control Area

Control Group

Overview

The control group activates the operational functions of the SD390. These include:

- **Gain Selection and Overload Control**
- **Update and Hold**
- **Averager Controls**
- **Waterfall Controls**
- **Cursor Controls**
- **Frequency Control**
- **Display Controls**

These functions can be activated by:

- Moving the Trackball Cursor over the desired function, then pressing the Trackball selector button, *or*
- Pressing the physical Function Keys next to the right of the screen, *or*
- Pressing the designated function keys on the optional keyboard.

The appearance of all SD390 controls reflect the operation that will be performed upon activating the control rather than on the current mode of the SD390. For example, when the update/hold control displays "Hold" the SD390 is in update mode and vice- versa.

Overload Control Group

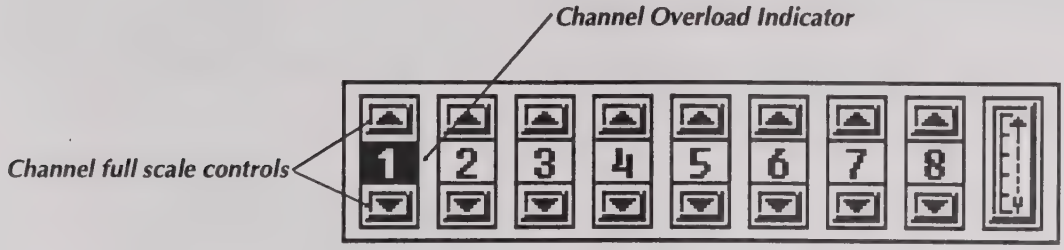
At the very left of the Control Area is the overload control group. Each overload control consists of two Channel Gain controls (one labeled with an up arrow, one with a down arrow), and an Overload Indicator (labeled with the channel number). The number of controls indicate the number of channels available with your SD390. The presence of these controls do not reflect whether the channel is active or inactive.

These controls are used to detect channel overloads and then to adjust the channel gain to remove the overload condition (channel under flow conditions are not indicated by the SD390). The values of these controls are on the Acquisition Setup Dialog and listed in the display info box.

In addition to the individual gain controls, there is one master AutoRange control that will select the most appropriate gain for each channel without saturating the input.

Channel gain should be set for the full amplitude range of the signal to be analyzed, but without overload. Full utilization of the input level range will optimize A/D conversion and result in more accurately resolved data.

An overload condition occurs when the signal input voltage exceeds the full scale maximum for a channel. This results in a "clipping" of the signal which distorts the channel data. Clipping appears as false "pulses" in the data displays and will result in false amplitude and spectral displays. The controls in the Overload Control Group provide a convenient means for resetting the channel full scale voltage in response to overload without having to invoke the Acquisition Setup Dialog to do so. However, initial settings should be made on the Acquisition Setup Dialog, then adjusted by the gain controls as required.



Channel Full Scale Controls

There are two channel full scale controls. The increase channel full scale control at the top, labeled with an up-arrow, and the decrease channel full scale control at the bottom, labeled with a down-arrow. By clicking with the trackball cursor on the appropriate control, you either increase or decrease the full scale range for the indicated channel.

Channel Overload Indicator

The channel overload indicator is labeled with the channel number. During a channel overload condition, the indicator is highlighted (on color systems, it changes from gray to red). When the overload condition is cleared, the indicator returns to its normal appearance.

Audio Overload Indication

The SD390 initialization file contains an entry which will enable an audible signal during overload. See the configuration section on SD390 Operating Files.

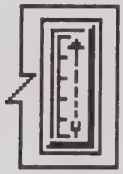
Overload Condition

When an overload condition is indicated, click on the channel gain up arrow control until the indicator clears.

During Free Run operation, overloaded signals are added to the averager. When an overload occurs while triggering is enabled, the current data will automatically be rejected from the averager.

☞ *When the SD390 is put into HOLD, the overload signals on all channels are cleared.*

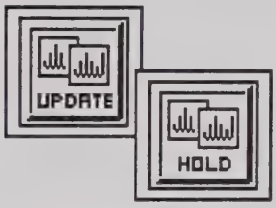
AutoRange



Auto Ranging for each active channel can be activated by clicking on the AutoRange selector to the right of the individual channel gain controls. When AutoRanging is activated, and acquisition is resumed, the SD390 will acquire data according to parameters set on the Acquisition Setup Dialog. The SD390 will choose the highest gain setting for each channel that will not cause clipping. This value will then be used for the gain until AutoRanging is activated again, or if the gain is manually changed via the channel gain controls or Full Scale Voltage parameter on the Acquisition Setup Dialog.

AutoRanging requires approximately 500 data points to determine an accurate setting. Therefore, AutoRanging at low frequencies could take several seconds.

Update/Hold Control



The Update/Hold control is located in the Control Area between the overload control group and the averager control group. This control controls the global data acquisition mode for the SD390.

Update

Clicking on the update control places the SD390 in update mode; the SD390 can acquire new signal data to its Recorder Memory and will update the appropriate Display Window traces provided that triggering conditions have been met (see the sections on triggering in the description of the Acquisition Setup Dialog and Recorder Memory).

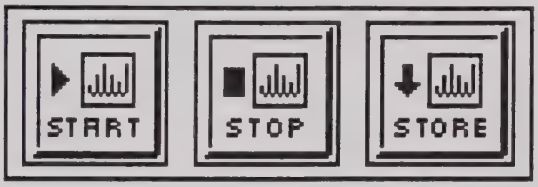
Although data is acquired synchronously, displays are updated asynchronously. Therefore, live displays may show data from slightly different times. When the SD390 is placed in HOLD, all displays are updated from the same instant in time.

Hold

Clicking on the hold control places the SD390 in hold mode. Signal acquisition is suspended and data for all displays are re-displayed coherently (i.e., the SD390 continues to display the data most recently acquired, not necessarily displayed, just before the SD390 was placed into hold mode). When in HOLD, data in the SD390's Recorder Memory can be reviewed by manipulating cursors available on Compressed Time Displays (see the sections on Extended Recorder and Cursors for more information on how to manipulate data in Playback).

When the SD390 is placed in hold mode, the averager automatically stops and all Display Windows displaying data from the averager display the most recent results of the Averager. To restart averaging, you must use the controls provided in the Averager Control Group to restart the averager, even if the SD390 is placed back in update mode.

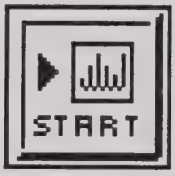
Averager Control Group



The averager control group lies within the Control Area between the update/hold control and the waterfall control. This group consists of three averager controls: average start, average stop/resume/single, and average store.

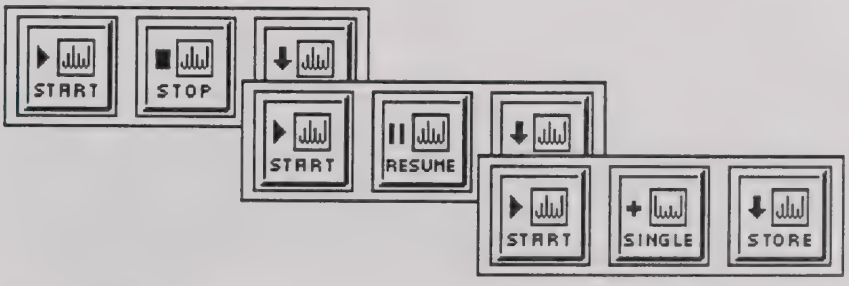
The averager controls are dynamic. That is, different controls appear and disappear depending on the current state of the averager. Only valid averager controls are displayed. Thus, it is not possible to perform an invalid averager operation.

Average Start Control



This control starts the SD390 data averager. If the averager is currently running, activating the start control is analogous to an average "reset." The current contents of the averager are cleared and the averager starts over.

Average Stop/Resume/Single Control



This control is actually several controls depending upon the current averager status.

Stop

The stop control appears when the averager is running (but not in the Single average method, as specified in the Analysis Setup Dialog).

☞ *Clicking on the **Stop** control "pauses" the averager to prevent incoming data from being averaged.*

Resume

The resume control appears when the averager has been stopped by use of the stop control. You cannot resume the averager if it has stopped by meeting the stop criterion as defined in the Analysis Setup Dialog.

☞ *Clicking on the **Resume** control will restart the averager from the state it was in when the stop control was activated.*

Single

The single control appears when the averager mode is Single as specified in the Analysis Setup Dialog.

☞ *Clicking on the **Single** control causes one block of analyzer data to be added to the current average.*

Store

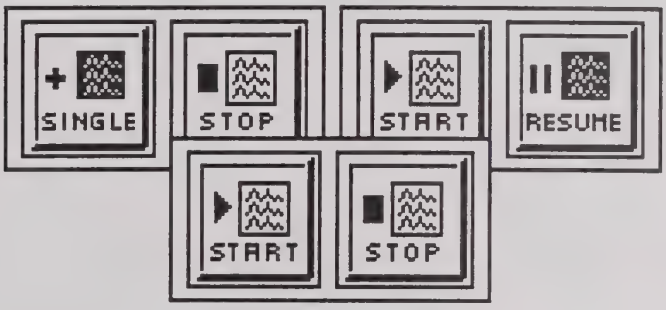
This control is used to store the current averager contents to the averager store memory. The data from the current averager in the selected Domain for each active channel, as specified in the Analysis Setup Dialog, is stored in the averager store memory.

Changing most Acquisition or Analysis parameters while the Averager is active will automatically stop the averager. The averager must then be manually restarted. Changing the Channel EU, Full Scale Voltage, Coupling, or averager count/time does not stop the averager.

The averager operates on normalized data, therefore changing the full scale voltage or coupling does not stop the averager. However, the amplitude axis of a displayed averager trace does not change when the gain changes. You must use Display Expand or AutoScale to view the full scale signal.

Waterfall Control Group

The waterfall load controls are located in the Control Area between the averager control group and the cursor controls. This group controls the loading of data into waterfall memory and consists of four waterfall controls: waterfall start, waterfall stop, waterfall resume and waterfall single.



The waterfall controls are dynamic. That is, different controls appear and disappear depending on the current state of the analyzer. Only valid waterfall controls are displayed. Thus, it is not possible to perform an invalid waterfall load operation.

Waterfall Start

This control starts loading data into waterfall memory from the specified waterfall source according to the specified load parameters as specified on the Waterfall Setup Dialog. If data loading is currently in effect, activating the start control is analogous to a waterfall memory "reset" - the current contents of the waterfall memory are cleared and waterfall loading starts over from the beginning of memory.

Waterfall Stop

The **Stop** control appears when data is actively being loaded into waterfall memory (except for Single Load). Clicking on this control "pauses" waterfall load procedure to prevent incoming data from entering waterfall memory. When **Stop** is pressed, each active waterfall display is refreshed with the most recent waterfall data.

Waterfall Resume

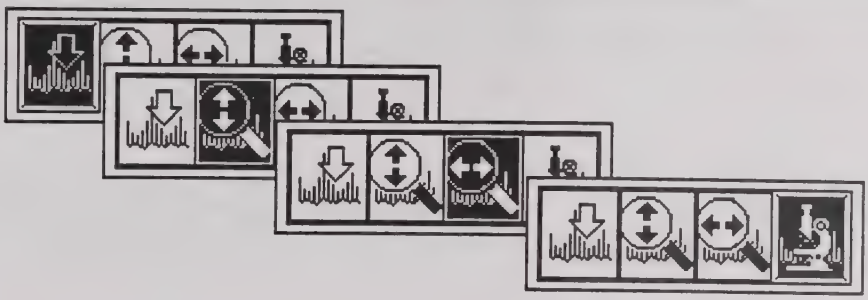
The resume control appears when waterfall load has been stopped by use of the **Stop** control. (You cannot resume loading waterfall memory if it has stopped by meeting the number of records to load in **Stop When Full** load method as specified in the Waterfall Setup Dialog). Clicking on the **Resume** control will restart loading waterfall memory from the state it was in when the **Stop** control was activated, without clearing the previous contents of Waterfall Memory. This control is not available when Waterfall Load is set to **Single**.

Waterfall Single

The **Single** control appears when the waterfall load control is Single (as specified in the Waterfall Setup Dialog) and data has been loaded into waterfall memory by the **Start** control. Clicking on the **Single** control causes one more block of data to be added to the waterfall memory from the specified data source. The **Stop** control is used to stop single loading, and allow the contents of waterfall memory to be cleared by presenting the **Start** control, rather than the **Single** control.

The appearance of the waterfall control reflects the operation that will be performed upon activating the control rather than on the current mode of the SD390. Thus, when the control displays "Stop" the SD390 waterfall is in the update mode and vice-versa.

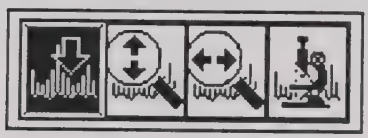
Cursor Control Group



The cursor control group contains three controls that determine the type of cursor available to the Display Windows. One, and only one, cursor type or Frequency Control (see next section) is active at any given time. Selecting one cursor type or the Frequency Control, will deactivate all other cursor type or Frequency Control selections. The current mode is indicated by highlighting of the corresponding cursor or frequency control.

There are three display cursor types: standard, or running cursor, horizontal display expand, or vertical display expand.

Standard Cursor



The Standard Cursor is useful for obtaining a numeric read-out of trace coordinates. The standard cursor is displayed as a vertical line with a (+) symbol at the intersection of the X and Y coordinates at the current cursor position. The coordinates of the trace where the cursor symbol is shown are displayed at the bottom of the Display Window.

Typically, the X and Y axis values and the overall (OA) level, in the axis units, are displayed for cursor read-out. For Orbit displays, time is displayed as the third cursor value. For Nyquist displays, frequency is displayed as the third cursor value. For Octave displays, the octave band and overall level are displayed as the third and fourth cursor values, respectively.

When the Standard cursor is active, the cursor can be moved in two granularities: course (general positioning) and fine (specific line or point positioning).

Coarse Positioning

The cursor line indicator appears as a thick downward-pointing arrow. Clicking within the Trace Rectangle will move the Cursor Select Line to that location. Use this method to place the cursor in the general vicinity of interest.

Fine Positioning

The position of the Standard Cursor can be fine tuned (line by line) by selecting the Display Controls on the desired Display Window, and moving the Trackball (or Mouse) right or left.

If there is no movement of the Trackball within 5 seconds of selecting the Display Control Cursor, cursor movement will revert back to coarse positioning.

When using the standard cursor on a Compressed Time Display when the SD390 is in HOLD, all LIVE displays are updated with the block of data that follows the Compressed Time cursor. This allows you to enter Playback mode, and access data that has been acquired to the Extended Recorder Memory.

Horizontal Display Expand Cursor

The horizontal display expand cursor is useful for shrinking and expanding the trace display along the horizontal axis. Use of this cursor does not alter the data. Instead, it modifies the number of spectral lines or time points of the trace being displayed.

In this mode, there are actually two related cursors available, depending on whether the cursor is within the Trace Rectangle or not.

Horizontal Display Expansion

If the cursor is within the Trace Rectangle, it appears as a magnifying glass with two horizontal arrows inside pointing outward. Clicking with this cursor causes the number of spectral lines or time points currently being displayed to be halved with the cursor position becoming the new center of the display. The process may be repeated until the number of spectral lines or time points would fall below the minimum number of 50 spectral lines or time points).

Horizontal Display Contraction

If the cursor lies outside the Trace Rectangle, it appears as a magnifying glass with two horizontal arrows inside pointing inward. Clicking with this cursor causes the display to revert back to displaying the full number of spectral lines or time points (as specified in the Analysis Setup Dialog).

The Standard Cursor will not automatically maintain its position when using horizontal display expansion. Instead, the user must manually reset the Standard Cursor after every expansion operation.

Vertical Display Expand Cursor

The vertical display expand cursor is useful for shrinking and expanding the trace display along the vertical axis. Use of this cursor has no effect on the state of the analyzer - it only modifies the display.

In this mode, there are actually two related cursors available, depending on whether the cursor is within the Trace Rectangle or not.

Vertical Display Expansion

If the cursor is within the Trace Rectangle, it appears as a magnifying glass with two vertical arrows inside pointing outward. Clicking with this cursor decreases both the minimum and maximum y-axis limits for a bipolar display by one range (ranges are defined as values of the form 1, 2, 4, 5 x 10n). The minimum absolute value for a limit is the next range greater than 1/10,000th of the absolute value of the original limit.

For a unipolar display (one whose minimum limit is always 0.000), the minimum limit does not change. For a bipolar display (whose limits are - n.nnn and +n.nnn), both limits decrease symmetrically so that 0.000 is still the vertical center of the display.

Vertical Display Contraction

If the cursor lies outside the Trace Rectangle, it appears as a magnifying glass with two vertical arrows inside pointing inward. Clicking with this cursor causes the display to revert to displaying the full scale vertical range (as derived from Acquisition Setup Dialog's Full Scale and Sensitivity settings).

It is recommended that the Cursor Control be left in the Standard Cursor Mode to prevent accidental frequency changes, or display expansion/contraction.

Frequency Control

The Frequency Control is used to increase or decrease the frequency range when the SD390 is in Spectrum baseband mode or Octave mode, or to select the center frequency and frequency span when in Spectrum zoom mode. (These modes are set by the Analysis Mode selector and Zoom Mode setting in the Sampling Method Group of the Acquisition Setup Dialog).

Selecting the Frequency Control deactivates the Cursor Control modes and displays a frequency indicator in the selected trace window. The frequency indicator is a right or left arrow in Baseband mode, or a magnifying glass in Zoom.

The Frequency Control is really just a shorthand method for changing the Frequency Span and Center Frequency settings of the Acquisition Setup Dialog. Since these settings are global, it does not matter which display window is used to perform the cursor operations since all display windows are simultaneously affected. Thus, it is not possible to perform one operation (e.g. Zoom In) in one display window and its opposite (Zoom Out) in another display window, or changing the Baseband frequency in only one Window.

Spectrum Baseband and Octave Modes

In these modes, there are two related frequency indicators displayed, depending on whether the indicator is within the left or the right half of the Trace Rectangle.

Frequency Span Increment

If the indicator is in the right half of the Trace Rectangle, it appears as a right-pointing arrow with the word "FRQ" inside. Clicking when this indicator is activated increases the frequency span limit up to the next "range" frequency.

Frequency span limits are in the ranges from 1 Hz to 100 kHz for 2 channel operation, or 1 Hz to 40 kHz for 3 to 8 channel operation in a 1, 2, 4, 5 sequence.

The sequence is 1.25 kHz, 2.5 kHz, 5 kHz, 10 kHz and 20 kHz for the Octave mode.

Frequency Span Decrement

If the indicator is in the left half of the Trace Rectangle, it appears as a left-pointing arrow with the word "FRQ" inside. Clicking with this indicator activated decreases the frequency span limit to the next lower "range" frequency.

Frequency span limits are in the ranges from 100 kHz down to and including 1 Hz for 2 channel operation, or 40 kHz down to and including 1 Hz for 3 to 8 channel operation.

The sequence is 20 kHz, 10 kHz, 5 kHz, 2.5 kHz and 1.25 kHz for the Octave mode.

Zoom Mode

In spectrum zoom mode, there are also two related indicators displayed, depending on whether the indicator is within the Trace Rectangle or not.

Zoom In

If the indicator is *within* the Trace Rectangle, it appears as a magnifying glass with a "+" symbol inside. Clicking with this indicator activated decreases the frequency span to the next lower "range" frequency (frequency ranges are of the form 1, 2, 4, 5 x 10n Hz down to and including 5 Hz (or to the lowest span permitted by the amount of XRec memory). In addition, the center frequency changes to the frequency indicated by the position of the indicator within the Trace Rectangle. Thus, if the indicator is in the center of Trace Rectangle at the click, the center frequency does not change. If the indicator is to the left of center, the center frequency will decrease; if to the right of center, it will increase. In zoom mode, the center frequency is constrained as follows:

span/2 ≤ center < 100 kHz - span/2 (2 channels)

span/2 ≤ center < 40 kHz - span/2 (3 - 8 channels)

Zoom Out

If the indicator is *outside* the Trace Rectangle, it appears as a magnifying glass with a "-" symbol inside. Clicking with this indicator activated restores the zoom span and center to those in effect when the user last clicked while the Zoom In indicator was active. If the total number of clicks using the Zoom Out indicator exceeds the total number of clicks using the Zoom In indicator, the zoom frequency span is automatically set to the maximum (100 kHz for 2 channel operation, 40 kHz for 3 - 8 channel operation) and the center frequency is set to half the span (50 or 20 kHz, respectively).

In zoom mode, the Frequency Control is not available for displays whose sources are storage memory (see the section on the Display Setup Dialog).

FREQUENCY NOTES

Display Controls

There are five Display Controls available for all Display Windows:

- **Locked Cursor**
- **Cursor Adjustment**
- **Scale**
- **Display Setup**
- **Information**

For Compressed Time Displays, there is an additional Limits Control when the SD390 is in HOLD and data is available in the Extended Recorder Memory for playback. For Waterfall Displays, there is a Waterfall Record/Profile Selection Control which allows further Waterfall data selection in Waterfall Data Recall Mode. For Waterfall Cascade Displays, Z Axis Controls are also available.

Locked Cursors

The cursor can be controlled from one display, and automatically move to the same X coordinate in "similar" displays. Each display has a padlock icon, which can be opened or closed. A closed padlock indicates that the cursor is locked on this display, and can either control other "similar" locked displays, or be controlled from other "similar" locked displays. An open padlock indicates that the cursor action only affects this trace. You open and close the padlock by clicking on this icon.

"Similar" displays are traces that agree in type (time, spectrum, orbit, nyquist, compressed time, etc.), resolution (or block size), and frequency. For example, when two time displays and two frequency displays are locked, the cursors for the time displays move in unison, and the cursors for the frequency displays move in unison, but the time and frequency cursors move independent from one another.

Cursor Adjustment

This button allows fine tuning of the standard cursor. When the standard cursor is selected from the Cursor Controls, pressing this button allows you to move the cursor line by line (or point by point) left and right, by moving the trackball left and right. If a keyboard is available, you may move the cursor using the left and right arrow keys. When the desired cursor location is found, press the trackball button to stop the cursor, and return to coarse positioning mode.

If the fine tune cursor select button is pressed and there is no trackball movement within 5 seconds, the cursor mode returns to coarse positioning.

For very dense displays, the cursor may not appear to be moving. This is due to the fact that many physical data points may be plotted on the same pixel of the viewing area. However, the cursor read-out values indicate the exact data coordinates in the selected units.

Scale

Selecting this function causes the Scale Dialog to be activated. This dialog allows you to set specific minimum and maximum values for each axis, to AutoScale the data, or to return to the default Full Scale values.

To manually scale the axes, you may enter specific minimum and maximum values for the X and/or Y axis in the designated fields of this dialog, then press "OK". Illegal or out of range (i.e., negative frequency values) will be ignored, and the previous value will remain unaltered. Some types of displays (i.e., coherence displays) will not allow manual scaling. To exit this dialog without changing the previous values, click over "Cancel."

Alternatively, you may AutoScale the data in the Display Window to fill the maximum area of the Window, by clicking over "AutoScale". The new minimum and maximum values for each axis will be displayed in their corresponding fields. You may AutoScale the data any time and as often as required.

You may also use this dialog to return to the default Full Scale axes limits by clicking over "Defaults".

Once AutoScale is selected, Display Expand is disabled. You can return to the default scaling limits by selecting Display Contract.

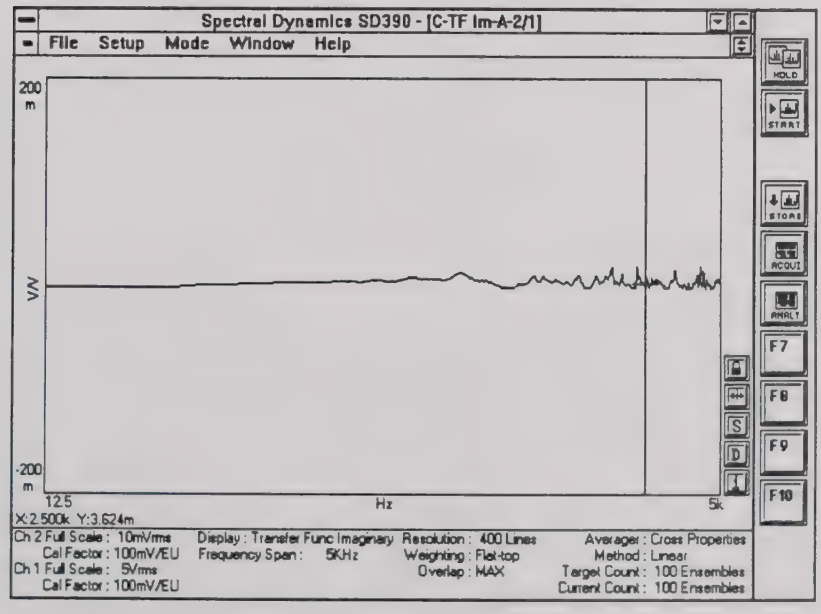
AutoScaling only adjusts the amplitude (Y) Axis, except for ORBIT and NYQUIST Traces. Use the appropriate axis Display Contract to return to the default scale for the desired axis.

Display Setup

This button invokes the Display Setup Dialog to allow you to modify the display parameters of the trace.

Information

The **"i"** button is located at the bottom right hand corner of the Display Window. Clicking on the button brings up a pop-up window at the bottom of the screen containing additional information about the trace.



Limits

The limits selector button only appears on Compressed Time Displays when the SD390 is in HOLD and there is data available in its Extended Recorder Memory. Setting Limits allows you to place markers at specified start and end locations of Recorder Memory to delimit the range of data to be analyzed in Playback Mode.

Pressing the Limits Control button causes the limits cursor () to appear in the Trace Window. Move this cursor to the desired starting position on the Compressed Time Display and press the Trackball button to select the start point. Then drag the cursor to the desired end position, and press the Trackball button to select the end point. While dragging the cursor, the desired range will be displayed in inverted video.

To cancel the current operation, move the limits cursor outside of the Trace Window. This will change the cursor symbol to "Click to Cancel", then press the Trackball button.

To cancel the Limits (i.e., remove the current limits settings), double click on the limits button.

For more information on the use of Limits, see the section on Playback.

When using display expand or contract, the limits are retained, but may lay outside the expanded area. In this case, the entire display area is inverted.

If all Compressed Time Displays are closed, the Limits still remain active until Update is pressed.

Waterfall Record/Profile Selection

The use of this dialog is discussed in Waterfall Record/Profile Selection section of the Waterfall Display Options.

Waterfall Cascade Z Axis Controls

For Waterfall Cascade Displays, Z Axis controls are also available. The use of these controls are discussed in the Waterfall Display section of this manual.

More on Printing / HardCopy

How To Invoke

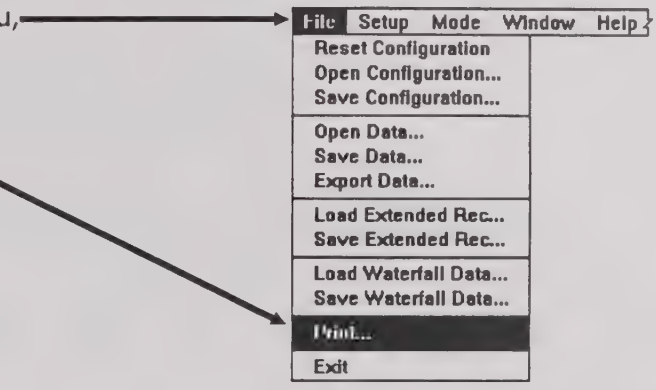
To invoke the Print Dialog:

➤ **Use the trackball to:**

Select the **File** menu,

and then

➤ **Select Print**



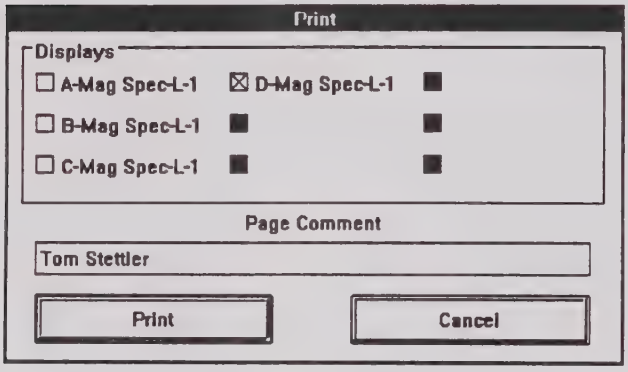
Description

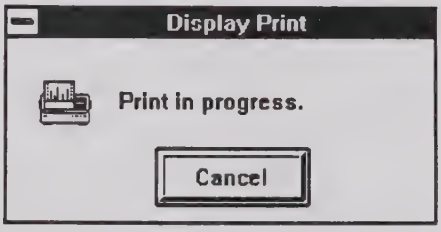
The Print Dialog is used to indicate that printing has begun and to provide a mechanism to cancel printing should the user wish to do so.

To cancel printing, click on the Cancel button within the first few seconds after the dialog appears. You will know that printing has been canceled if the dialog disappears shortly afterward (the button itself will not give any indication it has been clicked, so you must wait until the dialog disappears).

If Cancel was not activated in time, there is no way to stop the printing job and it will continue until the screen has been printed. Depending on the printer type and the SD390 configuration, printing the screen can take up to several minutes, so please be patient.

When **Print** is selected from the **File** menu, the **Print** dialog will appear on the display as shown in the following illustration. This dialog allows you to select the display you want to print and to add any comments to the display. When you select **Print** from the **Print** dialog, the dialog will disappear and be replaced with the **Display Print** message indicating that an active print is taking place.





After printing is complete (or printing has been canceled), the **Display Print** message disappears and the SD390 will return to normal operation.

Consult the Microsoft Windows documentation for information on configuring Windows for different types of printers.

More On Extended Recorder Memory

Overview

In the SD390, there is always a minimum of 8192 samples per channel allocated for extended recorder memory. The maximum number of samples is dependent upon the system configuration (either 1 MB or 4 MB of DSP RAM), and selected **Analysis Parameters**, such as **Analysis Mode**, the number of active channels, and FFT resolution.

The *total* amount of memory *available* for the Extended Recorder can be proportioned using the Memory Allocation control on the **Mode Menu**.

The maximum number of samples per channel is calculated each time a dependent parameter changes, and can be obtained by pressing the up-arrow on the memory control field of the analysis dialog.

Some typical figures for Recorder and Cross Spectrum modes are:*

Spectrum Mode							
1 MB				4 MB			
1 CH	2 CH	4 CH	8 CH	1 CH	2 CH	4 CH	8 CH
422912	209920	98816	- NA -	1891328	944128	471040	233427
Cross Properties Mode							
1 MB				4 MB			
1 CH	2 CH	4 CH	8 CH	1 CH	2 CH	4 CH	8 CH
418816	205824	88576	- NA -	1886208	940032	465920	216576

*The numbers in this table are typical (in samples). Actual numbers will vary according to the specific configuration of the SD390.

This memory is always active, and is the input memory buffer, regardless of whether it is used explicitly for extended recording. All of this memory can be used for pretrigger, and all but "blocksize" can be used for post trigger (negative and positive trigger delays). As data is acquired, the input memory is filled in a circular manner (i.e., when full, data again starts entering into the beginning of memory).

In Free Run with a frequency span of 20 kHz or less, memory is continually refilled until HOLD is pressed. When displaying live data, the data (or FFT) is from the last previously acquired block. When Hold is pressed, all data in the Extended recorder memory is available.

In Free Run with a frequency span of 40 kHz or greater, only the *blocksize* number of samples are acquired into the Extended Recorder Memory, then acquisition is paused for processing of this data. After processing, acquisition is resumed, starting again at the beginning of Extended Recorder Memory. Therefore, in this mode, only blocksize samples of Extended Recorder Memory are used.

There is currently no explicit provision for a "Stop when memory is full" condition. This can be accomplished by setting a single trigger negative delay equal to the selected memory size. You must make sure that a threshold is passed to trigger. This method must be used to acquire more than 1 blocksize into the Extended Recorder Memory when in frequency ranges of 40 kHz and greater.

Extended Recorder Memory and Triggering

In the Triggered Mode, for all frequency ranges, data is continually acquired into Extended Recorder Memory until a trigger is detected.

When a non-repetitive trigger is detected for a negative delay, one more block is acquired, then the system stops acquiring data. The last block (or FFT of) is displayed for LIVE displays, and all input memory prior to the end of the block is available.

When a non-repetitive trigger is detected for a positive delay, the number of samples specified as the positive delay are acquired, then the system stops acquiring data. The last block (or FFT of) is displayed for *live* displays, and all input memory prior to the end of the block is available.

For repetitive triggers, the Extended Memory is continually filled with new data while the trigger event is in the process of being detected. For frequency ranges 20 kHz and less, Extended Memory may contain varying numbers of trigger events (which include the pre or post trigger samples), if the trigger event is less than the amount of memory in Extended Recorder Memory.

If this condition exists, the Extended Recorder Memory does not contain discrete events with a specific positive or negative delay number of samples, but also contains data that is acquired while waiting to detect the trigger.

For 40 kHz and greater, Extended Recorder Memory will only contain one trigger event, plus the data acquired leading up to the event if the event is less than the maximum pre or post trigger delay.

Extended Recorder Memory and Zoom

The Extended Recorder Memory is also used to achieve Pseudo-Real Time Zoom above 10 kHz (when Center Frequency + 1/2Frequency Span exceeds 10 kHz). Data is first acquired into the Extended Memory, then immediately retrieved to perform the zoom spectrum calculation. Therefore, the amount of allocated XRec Memory will directly determine the minimum zoom span. If the zoom span is expressed in terms of a zoom factor (e.g. for a 20 Hz span at an analysis range of 40 kHz, the zoom factor is 40 kHz/20 Hz or 200), the amount of memory required is approximately:

$$(\text{BlockSize} + 80) \times \text{zoom factor} \times 2$$

samples per channel. From this example, and a blocksize of 1024 (400 line resolution), the amount of XRec memory required is approximately 441600 samples per channel, which is well within the range of the SD390.

If the required amount of memory is not available, the minimum zoom span will automatically be limited. You can determine this minimum value from the frequency span parameter on the acquisition dialog.

When the prime requirement for using the SD390 is zoom, it is good practice to set XRec memory to the maximum value. If sufficient memory is not available for the desired zoom, changing the mode, channel and blocksize parameters will allow further changes in memory size.

When pseudo-Real Time zoom is active, it may take a long time to acquire and process the data. For example, to acquire 441,600 samples of data at a frequency range of 40 kHz (102 kHz sample rate), it will take approximately 4 seconds just to acquire the data. The data must then be processed by the zoom transform algorithm, which will take a few additional seconds. Displays and averages will not be available until this processing is finished.

Viewing Extended Recorder Memory While Acquiring Data

LIVE Compressed Time displays are available for 20 kHz and below. These displays show the most current data entering from the right, moving to the left. All Extended Recorder Memory is displayed, compressed to 512 min/max pairs. That is, the total available memory (e.g., 32768 samples) is divided by 512 x 2 to yield a compression ratio (e.g., 32). From each compressed block of data, the min and max values are displayed on the screen. The cursor can be moved to indicate the amplitude and relative time of a sample. Display expand is also available. While in a trigger mode, LIVE Compressed Time displays are "Not Available" until the trigger is detected.

☞ *For 40 kHz and greater, only 1 blocksize is displayed in the Compressed Time display.*

Manipulating XTIME Data - Playback

The system must be placed in HOLD to review extended memory data in "playback mode." At least one compressed time display (with cursors) must be available for selecting playback position and limits.

Moving the cursor on a Compressed Time display in HOLD, will update other "LIVE" displays with data to the right of the cursor. The amount of data is determined by the current Blocksize Analysis parameter. You may change any analysis parameter (except the channel list) while in "playback" mode. This will invalidate the current AVGR, but will allow examining "LIVE" data from the Extended Memory with different parameters, and will allow re-averaging. Changing the channel list will invalidate the Extended Recorder Memory.

Changing any Acquisition parameter (except EU) has no effect on the Extended Recorder Memory or displays. Changes to the Acquisition parameters do not take effect until UPDATE is pressed.

Averaging XTIME Data

Single (+1) Averaging from XREC

Simply select Manual Averaging from the Analysis dialog, then position the cursor to the desired section of Extended Recorder Memory. Use the Start and +1 buttons as you would for LIVE data.

Continuous Averaging from Extended Recorder Memory

You are able to automatically average data in Extended Memory by selecting Start and End Limits via the limits cursor. The section of data between the start and end points (rounded to the next lowest blocksize) is displayed inverted, and will be used for averaging when AVG START is pressed while in HOLD. The number of averages will be automatically calculated based on the section of data, blocksize and overlap. This number WILL NOT be reflected on the Analysis Dialog. The Dialog will show the selected "Real Time" target. You must use the INFO box on any RT display (the current Compressed Time display is most convenient) to see the calculated Target count while in playback. The limits can be repositioned, and/or new analysis parameters can be selected, and the averager can be restarted.

Save/Recall XREC Data

The system must be in HOLD when Extended Recorder Memory data is saved or recalled. If not, when the Save or Recall selection is made, the system is put into HOLD. Save XREC will save all Extended Recorder Memory data from all channels into the named file. The current Acquisition and Analysis parameters are also saved with the file. When Extended Recorder Memory data is re stored from a file, the state of the machine could change, as the Acquisition and Analysis parameters that were stored with the data are loaded into the machine.

To streamline the recall of saved **.xrc** files, it is strongly recommended that a configuration file be saved along with the **Save Extended Rec** data file. Use the same file name with **.cfg** appended under the Save Configuration File.

Because **Save Extended Rec** is a global command that affects more than the "hot" compressed trace window, you should recall the **.cfg** file before recalling the **Load .xrc** file to ensure proper analyzer display setup for the recalled **.xrc** file.

SD390 Operating Files

In addition to the DOS and the Microsoft Windows Operating System files, the SD390 is provided with five essential operating disk files in the \SD390 directory on the hard disk:

➤ **SD390.EXE** - the executable image of the SD390 analyzer

➤ **DSP.DNL**- executable DSP code

➤ **SD390.HLP** - on-line documentation

➤ **SD390.INI** - initialization file

➤ **FNKEY.DLL** - support library

Except for specific items in the **SD390.INI** file, these files ***must not*** be altered or removed.

Certain items in the **SD390.INI** file may be modified by using any convenient text editor. These are:

```
[Display]
ControlsAtop=0 (or 1)
FunctionKeys=1 (or 0)
```

These items are used for information regarding the visual presentation on the screen of the SD390. There are two options:

The **ControlsAtop** item determines the location of the Control Area.

A value of (0) indicates that this area is positioned at the bottom of the screen.

A value of (1) indicates that it will be positioned at the top of the screen, below the SD390 title bar.

The **FunctionKeys** item specifies whether the Function Key Area is displayed (1) or not (0). Whether this area is displayed or not, the function pushbuttons and keyboard function keys remain active. When the function key area is not displayed, the extra screen space is claimed by the SD390 main window. The default value is 1.

[Settings]

This item is used for setting the audible channel overload tone.

The audible tone is indicated by:

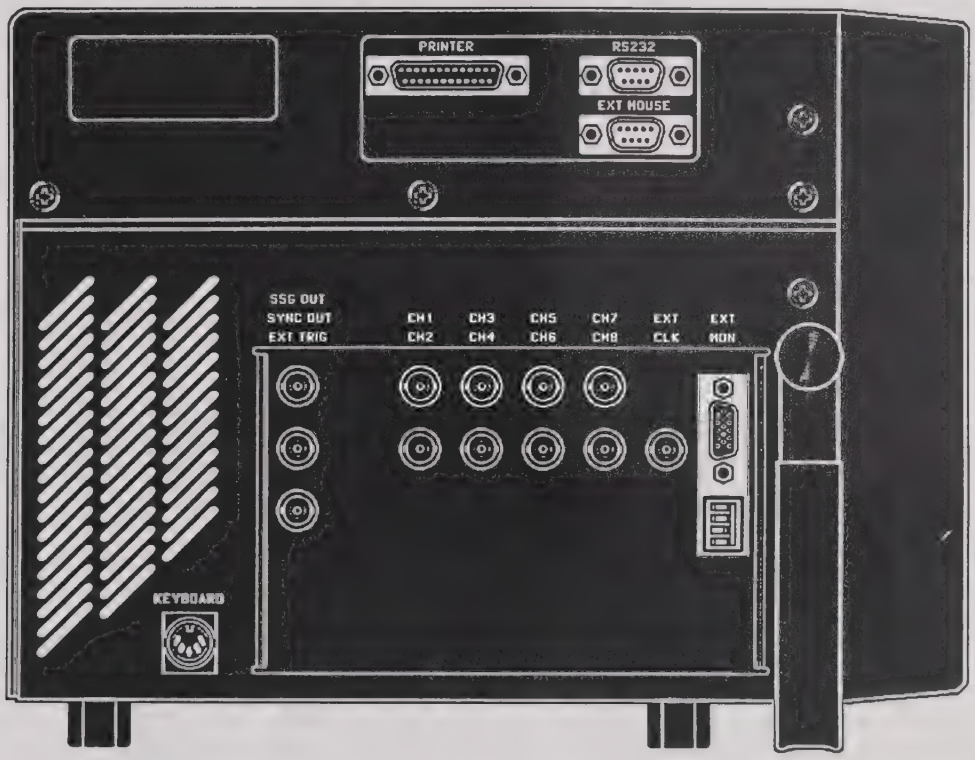
```
; Channel overload tone in Hertz. 0=off
OverloadTone=1000
```

The number is the frequency of the tone. To disable the tone, set the tone frequency to 0.

☞ *All other items **must not** be modified.*

Side-Panel Connectors

Located on the left side of the SD390 are various signal connectors and interface connectors. The following is a brief description of these connectors.



Description of the Side-Panel Connectors

SSG OUT

With the SSG Option installed, the SSG OUT BNC connector provides one of five types of signal outputs. The output signal type and amplitude are controlled by the **Noise Generator and Sine Generator Setup** menus.

SYNC OUT

A TTL trigger output coincident with the start of each random sequence is provided at the SYNC OUT BNC connector. Each sequence length matches the memory period of the analyzer. This output can be used as the SYNC TIME trigger input for the SYNC TIME averaging functions.

EXT TRIG

The EXT TRIG Connector is for applying an external trigger or tachometer signal. This connector can accept either an ac coupled or dc coupled signal.

CH1 ➞ CH8

These connectors accept the input analog data signals for Channels 1 through 8. The number of connectors available depends on the installed options.

EXT MON

The EXT MON connector is a *standard* 15-pin VGA RGB connection. Refer to the following table for pin assignments.

EXT MON Connector Pin Assignments

PIN #	I/O	Assignment	Mono Use	Color Use
1	>	Red		Red
2	>	Green	Mono	Green
3	>	Blue		Blue
4		Reserved		
5		Digital Ground	Self Test	Self Test
6	<	Red Return	Key	Red Return
7	<	Green Return	Mono Return	Green Return
8	<	Blue Return		Blue Return
9		Plug		
10		Digital Ground	Ground	Ground
11		Reserved		Ground
12		Reserved	Ground	
13	>	Horiz. Drive	Horiz. Drive	Horiz. Drive
14	>	Vert. Drive	Vert. Drive	Vert. Drive
15		Reserved		

KEYBOARD

Accepts a standard 5-pin DIN male connector. Refer to the following table for pin assignments.

KEYBOARD Connector Pin Assignments	
Pin #	Assignment
1	+ Keyboard Clock
2	+Keyboard Data
3	- Keyboard Reset
4	Ground
5	+ 5 Volts

PRINTER

This connector accepts a standard 25-pin parallel printer cable. Refer to the following table for pin assignments.

PRINTER Connector Pin Assignments		
Pin #	**I/O**	**Assignment**
1	< >	- Strobe
2	>	+ Data Bit 0
3	>	+ Data Bit 1
4	>	+ Data Bit 2
5	>	+ Data Bit 3
6	>	+ Data Bit 4
7	>	+ Data Bit 5
8	>	+ Data Bit 6
9	>	+ Data Bit 7
10	<	- Acknowledge
11	<	+ Busy
12	<	+Paper End
13	<	+Select
14	<	- Auto Feed
15	< >	- Error
16	< >	- Init. Printer
17	<	- Select Input
18 - 25		Ground

RS232

RS232 Connector is a DB9-pin connector that satisfies RS-232-C requirements. This connector provides interface capability with various RS232 devices. Refer to the following table for pin assignments.

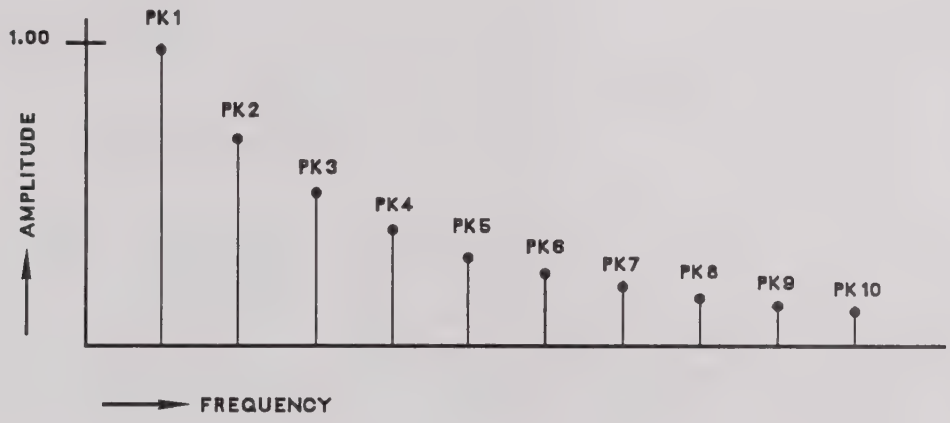
RS232 Connector Pin Assignments	
Pin #	**Assignment**
1	DCD (Data Carrier Detect)
2	RX (Receive Data)
3	TX (Transmit Data)
4	DTR (Data Terminal Ready)
5	GND (Signal Ground)
6	DSR (Data Set Ready)
7	RTS (Request To Send)
8	CTS (Clear To Send)
9	RI (Ring Indicator)

EXT MOUSE

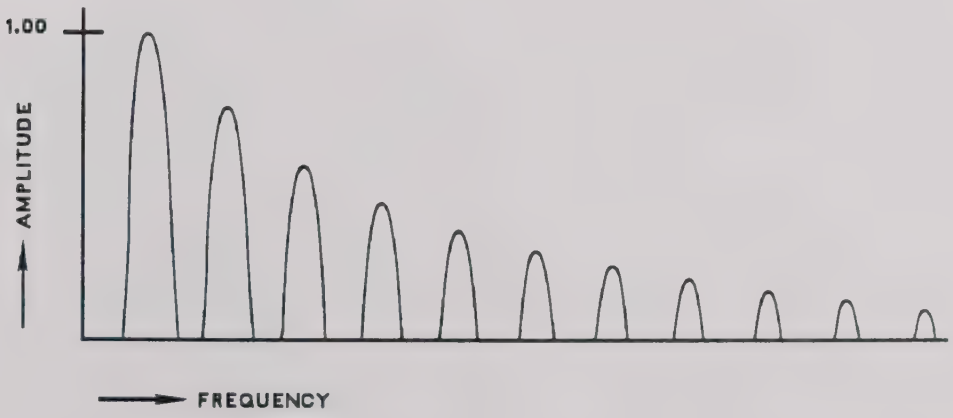
Standard connector for an external ***serial*** mouse.

FFT Weighting

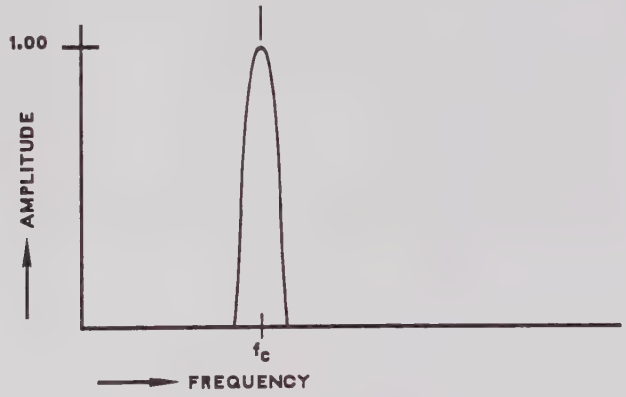
The earliest spectrum (or harmonic) analyzers consisted of tunable, high Q filters with a frequency dial and a standard analog voltmeter connected to the output of the filter. As the operator swept across the frequency band of interest, the meter would "peak" at various frequencies. The operator, typically, would plot (by hand) the frequency and magnitude of the peaks. The plot may have looked like the following figure.



The previous plot however, is not a true representation of a spectrum plot. If the frequency dial and voltmeter readings of the analyzer were connected to the X and Y-axis of an X-Y recorder, the obtained plot would resemble the following figure.



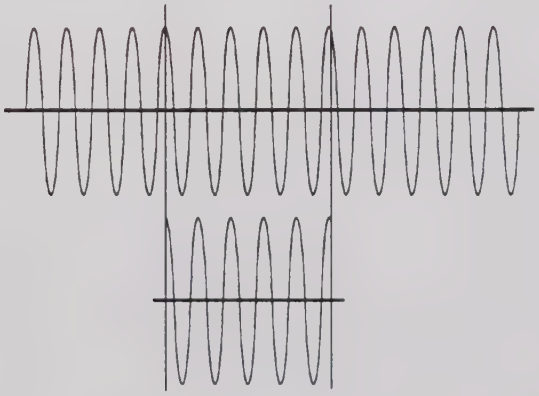
The harmonic plot of the previous figure is the result of tuning a filter past a stationary signal that contains more than one frequency component. If the filter is tuned to a frequency and a swept frequency signal is applied, the resultant filter response would resemble the following figure.



Filter Response of a High Q Filter

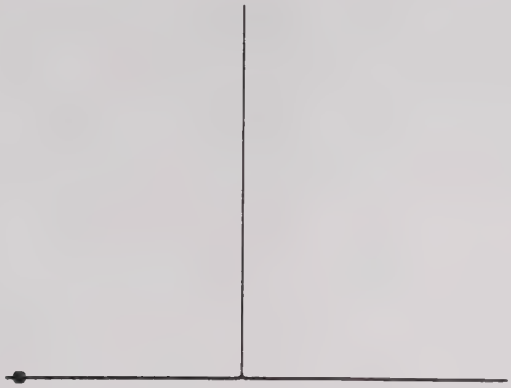
A digital spectrum analyzer carries the spectrum analysis concept even farther. It simultaneously displays the output of up to 1600 equally spaced, digital filters. This is accomplished by using a high speed discrete Fourier Transform called The Fast Fourier Transform (FFT). FFT analysis allows the rapid transformation of discrete time domain data into frequency domain data. The end result is up to 1600 values representing the simultaneous output of each high Q filter.

Since the FFT is performed on a finite sample, incongruities such as side lobes, spurious noise, etc., can cause false data to be acquired. Weighting is a technique for treating data in the time domain, before the FFT, to reduce the effect of side lobes, etc. The FFT of the signal shown in the following figure is performed on the data in the sample window.

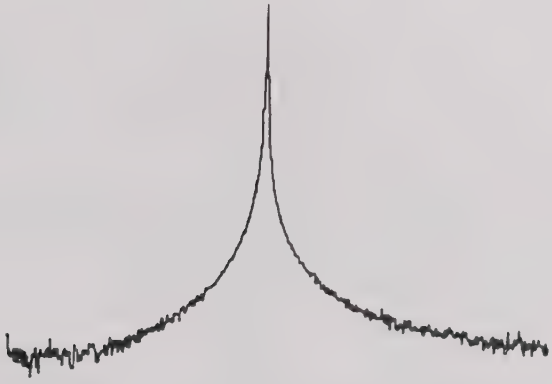


Sample Window

The following illustrations show the difference between "true" spectrum data and FFT data.

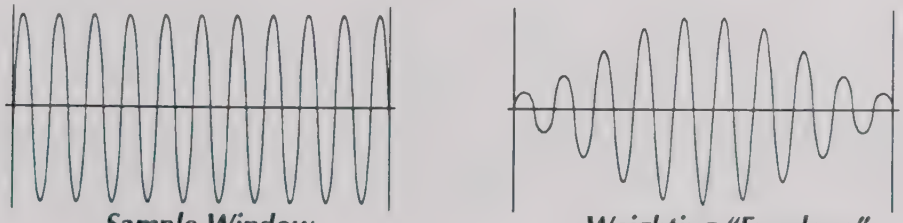


"True" Spectrum of the Sample Window Data



FFT of the Sample Window Data

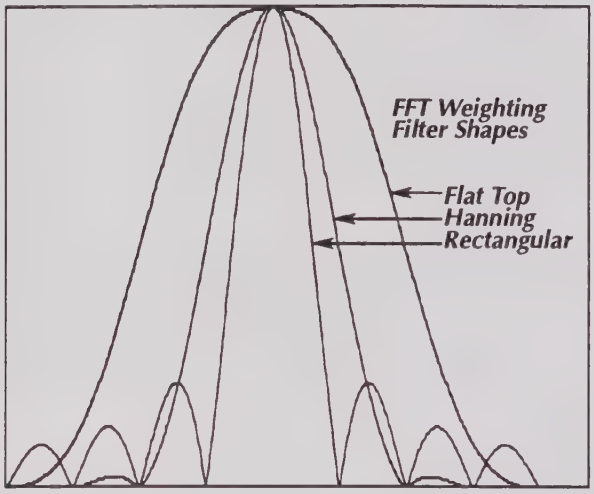
This phenomenon is called "flaring" or "leakage" and can be caused by "Rectangular" weighting, since *no* weighting is applied to the data before the FFT is performed. Weighting eliminates the flaring by smoothing the transitions on each side of the sample window.



Sample Window *Weighting "Envelope"*

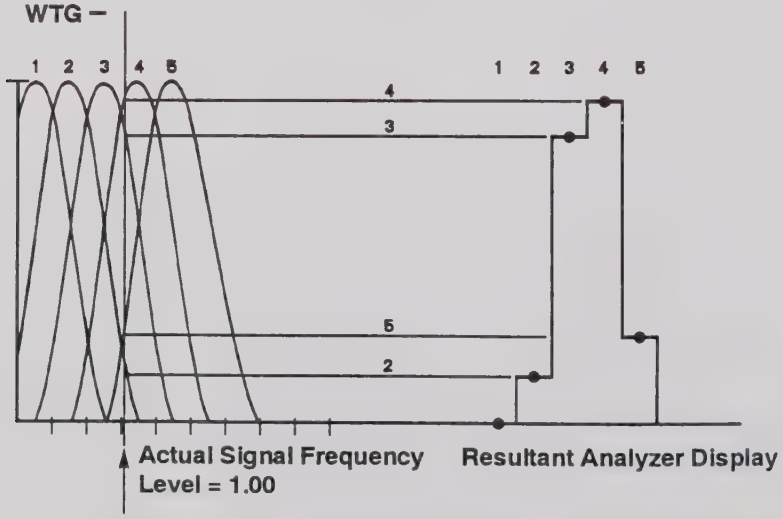
Weighting Effects on the Sample Window Signal

An additional effect weighting has on the data is the effective shape of the digital filters that produce the display. This filter shape could he measured by slowly sweeping a signal through the filter and measuring the response. A "swept sine" plot of a single filter would produce the following filter shapes for Rectangular, Hanning and Flat Top weighting:



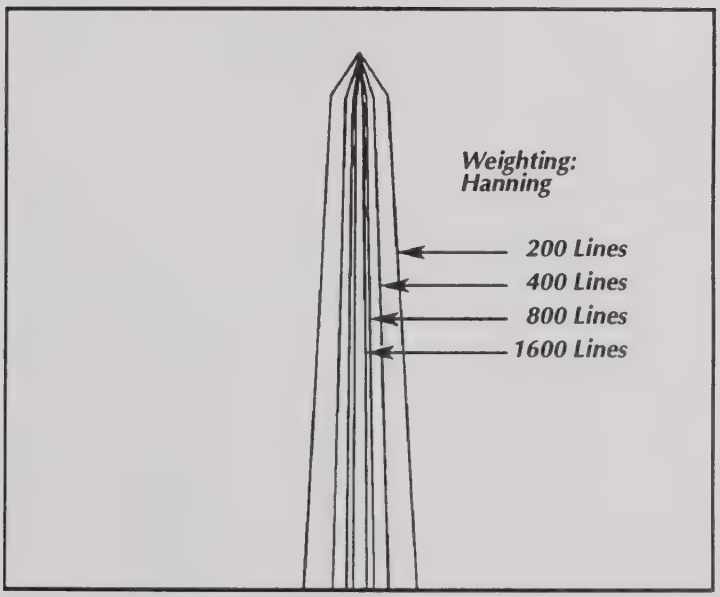
Filter Shapes of the Various Weighting Functions

There are up to 1600 filters overlapping each other on the SD390 display. The displayed data are actually the vectors between the output data points at the applied frequency. The following figure shows the analyzer display of a signal measured with Hanning weighting.

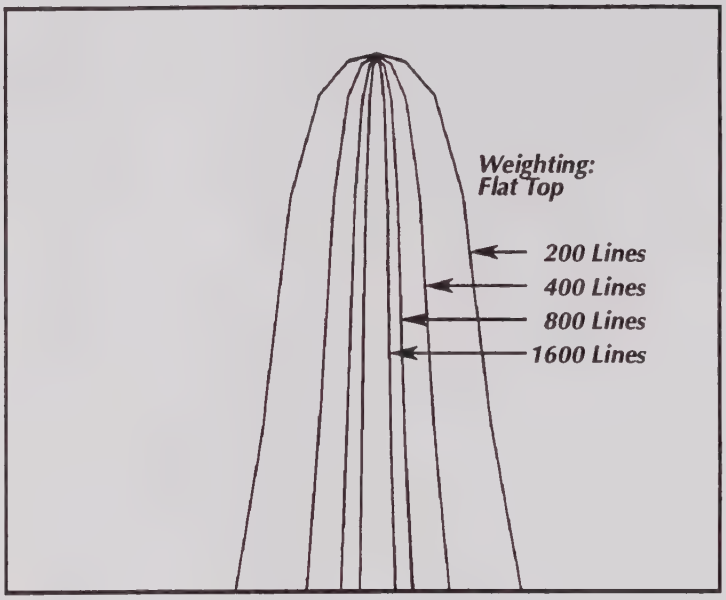


Generation of a Weighted Analyzer Display

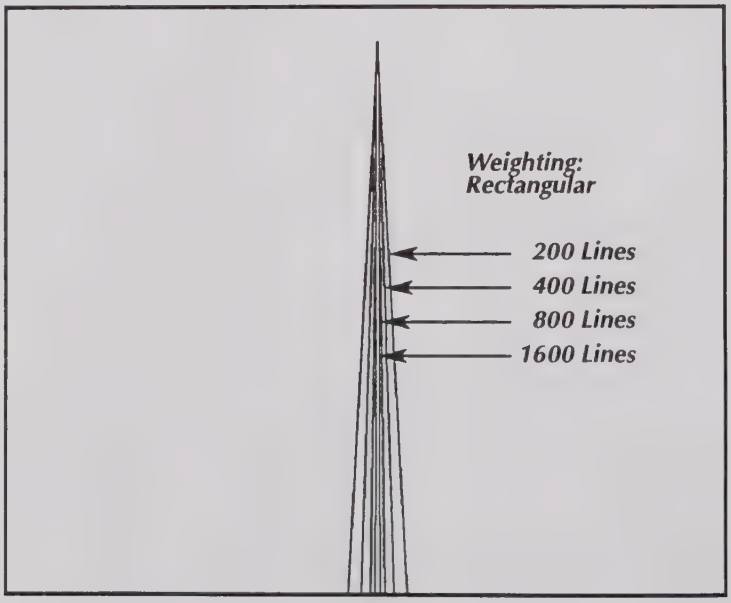
The following three figures are examples of the first three weighting functions from the Process Control menu. The applied input signal was identical for all three weighting functions. In addition, the actual width of the filters depends upon the selected resolution (number of lines). Each weighting function shown in the following three illustrations also shows how resolution selection affects filter width.



Hanning Weighting Example



Flat Top Weighting Example

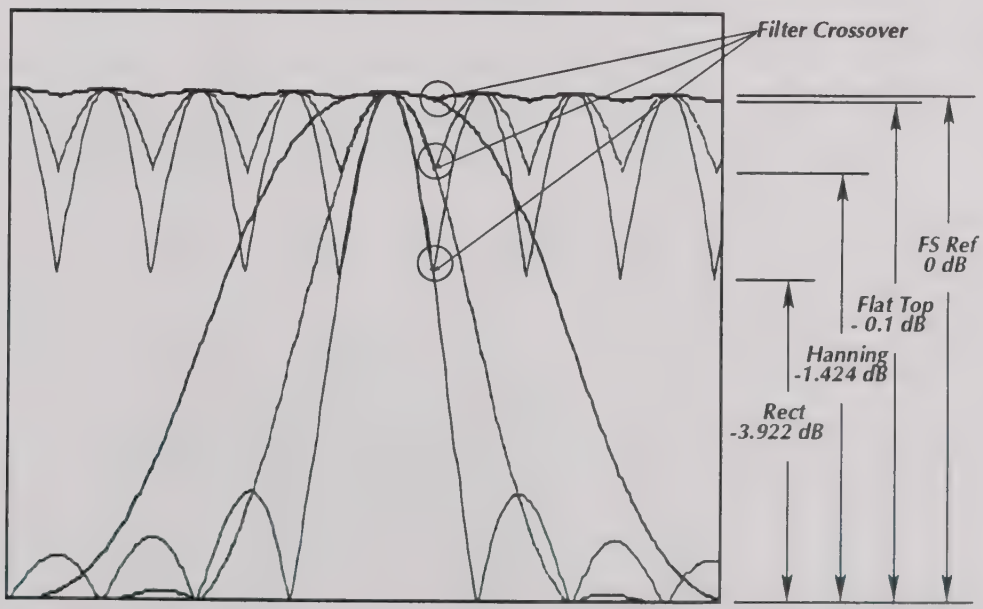


Rectangular Weighting Example

If we were to plot the measured signal peak versus input frequency across the weighting filters, we would notice an effect called "scalloping." It (scalloping) reflects the variation in amplitude of a measured tonal as it passes into and out of the digital filter centers. Examples of this effect are shown in the following figure. Note that as the tonal passes from the center of one filter to the center of the next filter, the amplitude of the tonal will decrease as it passes between the filter centers (the point at which the filters overlap) and then increase as it approaches the next filter center. This variation in amplitude reflects the percentage of scalloping for each weighting-function filter shape.

In an environment where the amplitude of a signal (tonal) is extremely important, Flat Top weighting can insure that filter shape does not affect measured amplitude. For example, if you were to sweep a signal across a particular band, you would notice that the "next filter" would rise to signal strength before the "current filter" started to descend.

Harris Flat Top weighting (the method of Flat Top weighting the SD390 uses) gives you the necessary flat response without sacrificing any more frequency resolution than necessary.

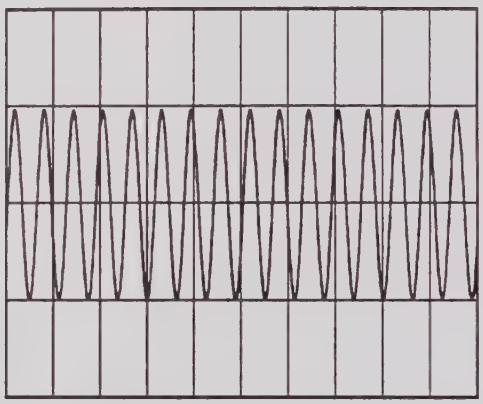


Hanning, Flat Top & Rectangular Scalloping Examples

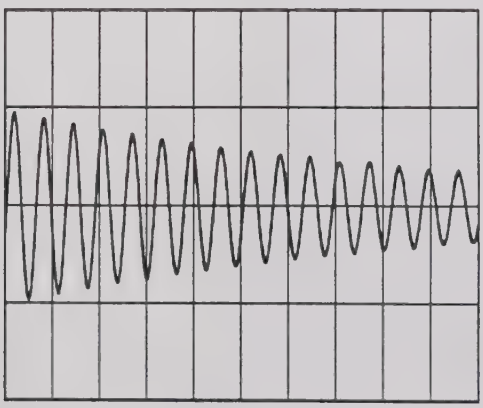
Response Weighting

The remaining selection on the Process Weighting menu, Response, is a special weighting algorithm. This weighting algorithm enhances signal analysis for impact testing and other types of transient response testing.

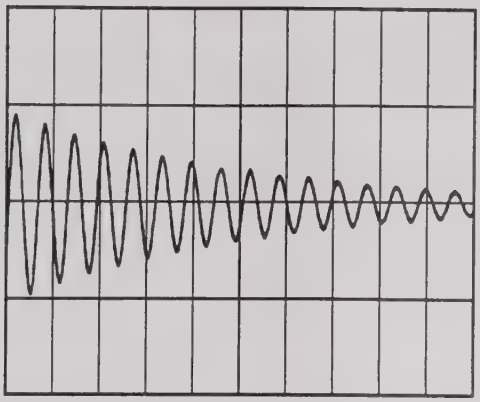
Response Weighting applies an exponential damping envelope to the data. The TAU menu that appears when Response Weighting is selected allows for choosing different amounts of damping. The following illustrations are examples of TAU selections 1 through 4 and show the effects of the response window when applied to SD390 time domain displays. This allows you to visually ensure the proper TAU for the unit under test.



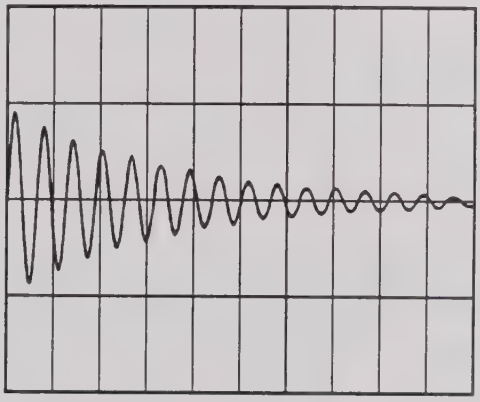
Example of a Signal Before Response Weighting is Applied



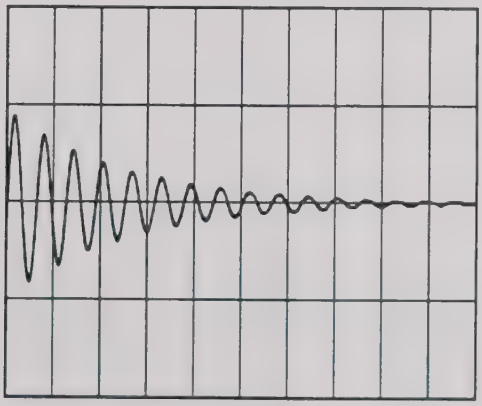
Response Weighting With a TAU of 1. Last Cell is Attenuated 1/e



Response Weighting With a TAU of 2. Last Cell is Attenuated $1/e^2$



Response Weighting With a TAU of 3. Last Cell is Attenuated $1/e^3$



Response Weighting With a TAU of 4. Last Cell is Attenuated $1/e^4$

The primary application for response weighting is narrow- width impulse type data. This type of signal data may have a poor signal-to-noise characteristic. Noise information that is 60 dB down may be significant when compared to an impulse which may have a total area on the order of one or two cells. Even though the noise information has an amplitude at any one cell of about 1/1000th of the amplitude of the impulse, the noise occupies all 1024 cells. Hence the noise rms is on the same order as the impulse rms.

Using trigger delays to position the impulse close to the beginning of the Memory Period, Response Weighting can be used to zero out most of the noise and vastly improve the signal-to-noise characteristic of the measurement.

FFT Weighting Summary

Weighting selections are totaly dependant on the desired data. Some basic rules of thumb to follow:

➤ Rectangular ➡ Superb frequency resolution, poor amplitude accuracy.

➤ Flat top ➡ Poor frequency resolution, superb amplitude accuracy.

➤ Hanning ➡ Good compromise.

If you're not sure, start with Hanning, check Rectangular and then possibly Flat-top if the signal is periodic.

➤ Response ➡ Always used for impact testing for Transfer Function or Cross Properties data.

Other References

The following additional manuals may be useful for advanced operation of the SD390:

Microsoft Windows Users Manual

Dos Reference Guide

Date/Time

The current system date and time are displayed at the left-hand side of the Status Area.

The date and time must be changed using either the Date/Time application included with Microsoft Windows or by using the "date" and "time" commands of DOS. Please consult the appropriate manuals, which were shipped with your SD390.

NOTES

Section 9 - Field Calibration Verification Tests

Test Description

This test is used to verify that the SD390 measures an input signal within its specified accuracy limits.

The SD390 does not contain any user adjustable calibration parts. If the unit does not meet its specified accuracy, contact the factory.

This calibration test supports SD390 versions 3.1 and above. Select **"About SD390"** from the Help pull-down menu to determine the version of the unit to be tested.

Test Equipment

The following test equipment is required for running the Calibration Verification Tests. If other test equipment is substituted, it must meet or exceed the specifications of the required test equipment.

Required Test Equipment		
SD390 Calibration Test Disk	2-F3-018	Scientific-Atlanta
Synthesizer/Function Generator with 40 Vp-p high Voltage option (002)	HP3325B	Hewlett-Packard
Keyboard	AT compatible	101 enhanced
Assorted 50 ohm coax cables, terminators, BNC tee connectors and shorting plugs		

The signal generator output settings must be set to within ± 1.0% of the values specified in the following steps.

Calibration Verification Test Definition

The Calibration Verification Test is used to determine the integrity of the SD390. The tests ensure noise floor filter flatness, input signal amplitudes, input signal frequency, etc. The test also verifies the proper operation of the user controls and internal display.

The SD390 must be configured with the test configuration files contained on the Scientific-Atlanta 3.5" floppy disk (2-F3-018). This disk contains a unique set of files for each hardware configuration of 2, 4, 6, and 8 channels units. Upon initial execution of the test the operator will be prompted to indicate the number of channels, and then the appropriate test configuration files will be loaded on to the internal hard drive of the SD390. The test configuration files are listed in the Table 9-1.

CAUTION

Any existing configuration files with the same name as those listed in Table 9-1 will be destroyed. Protect any such files as necessary.

Actual measurement results may be stored for archival purposes. This is not required but is a feature that would facilitate verification of field measurements should data validity questions arise. It is recommended that pre-measurement calibration verification data files be stored on properly formatted 3.5" removable floppy disks and not on the internal hard drive.

If there is a requirement for an NIST or MIL SPEC calibration, contact Scientific-Atlanta's customer service department.

Table 9-1 Test Configuration Files

2 Channels 17 Files	4 Channels 18 Files	6 Channels 27 Files	8 Channels 28 Files
TEST001.CFG	TEST001.CFG	TEST001.CFG	TEST001.CFG
TEST002.CFG	TEST002.CFG	TEST002.CFG	TEST002.CFG
TEST005.CFG	TEST005.CFG	TEST005.CFG	TEST005.CFG
TEST011.CFG	TEST011.CFG	TEST011.CFG	TEST011.CFG
TEST012.CFG	TEST012.CFG	TEST012.CFG	TEST012.CFG
TEST019.CFG	TEST019.CFG	TEST019.CFG	TEST019.CFG
TEST021.CFG	TEST021.CFG	TEST021.CFG	TEST021.CFG
TEST022.CFG	TEST022.CFG	TEST022.CFG	TEST022.CFG
TEST024.CFG	TEST024.CFG	TEST024.CFG	TEST024.CFG
TEST025.CFG	TEST025.CFG	TEST025.CFG	TEST025.CFG
TEST035.CFG	TEST035.CFG	TEST035.CFG	TEST035.CFG
TEST203.CFG	TEST035A.CFG	TEST035A.CFG	TEST035A.CFG
TEST203A.CFG	TEST203.CFG	TEST101.CFG	TEST101 .CFG
TEST204.CFG	TEST203A.CFG	TEST102.CFG	TEST102 .CFG
TEST204A.CFG	TEST204.CFG	TEST105.CFG	TEST105 .CFG
TEST205.CFG	TEST204A.CFG	TEST111.CFG	TEST111 .CFG
TEST206.CFG	TEST205.CFG	TEST112.CFG	TEST112 .CFG
	TEST206.CFG	TEST119.CFG	TEST119 .CFG
		TEST121.CFG	TEST121 .CFG
		TEST125.CFG	TEST125 .CFG
		TEST135.CFG	TEST135 .CFG
		TEST203.CFG	TEST135A.CFG
		TEST203A.CFG	TEST203 .CFG
		TEST204.CFG	TEST203A.CFG
		TEST204A.CFG	TEST204 .CFG
		TEST205 .CFG	TEST204A.CFG
		TEST206 .CFG	TEST205 .CFG
			TEST206 .CFG

Setup

Perform the following setup steps prior to running the verification test.

1. Make sure that the SD390 to be tested is not powered up.
2. Attach the keyboard to the KEYBOARD port.
3. Turn the SD390 power on and wait for the unit to boot and the SD390 program screen is displayed.
4. Close the SD390 program and select the PROGRAM MANAGER.
5. Exit the Windows environment and return to the DOS prompt.
6. Insert the SD390 Calibration Test Disk into the floppy drive and change to the A drive by entering "A: [Enter]" at the DOS prompt.
7. Enter **"CAL390 ↵"** at the DOS prompt.
8. When prompted, enter the number of installed channels of the SD390 and the appropriate configuration files will be loaded.
9. After the files are loaded remove the SD390 Calibration Test Disk from the floppy drive. Cycle the SD390 power off and then on to reboot the unit.

Running The Verification Tests

Test Channels 1 through 4

1. Attach the synthesizer to the Channel 1 and Channel 2 input BNC connectors. If the SD390 has more than 2 channels installed, also attach the synthesizer to the Channel 3 and Channel 4 input BNC connectors. Enable the 40 Vp-p option on the synthesizer and do not terminate the line in 50 ohms. If the 40 Vp-p option is not enabled all measurements will be off by 6 dB.

2. Load test setup **test001.cfg** as follows:
   a. Select the File menu on the top bar of the display.
   b. Select the Open Configuration item from the File menu.
   c. Select the **test001.cfg** from the Open Configuration menu and then select OK.

   Set the synthesizer for a 1 volt rms sine wave at 2000 Hz.

   Verify that the display shows a signal at 2000 Hz and between -0.25 dBV and +0.25 dBV on all displayed channels.

3. Load test setup **test002.cfg**. Change the synthesizer to 10 kHz.

   Verify that the display shows a signal at 10 kHz and between -0.25 dBV and +0.25 dBV on all displayed channels.

4. Load test setup **test005.cfg**. Change the synthesizer to 2 kHz.

   Verify that the display shows a signal at 2 kHz and between -0.25 dBV and +0.25 dBV on all displayed channels.

5. Load test setup **test011.cfg**. Start the averager by selecting the START function key (F2) on the SD390.

   Verify that all tonals other than the 1 kHz primary tonal are at a maximum level of -70 dB on all displayed channels.

6. Load test setup **test012.cfg**. Start the averager by selecting the START function key (F2) on the SD390.

   Verify that all tonals other than the 1 kHz primary tonal are at a maximum level of -70 dB on all displayed channels.

7. Load test setup **test019.cfg**. Set the synthesizer for 1.2 Vrms at 1 kHz.

   Verify that all displayed channels show an overload indication (indicated by the corresponding Channel Overload Indicator going to reverse video).

Decrease the input level to 1.0 Vrms.

Verify that all channels are no longer in overload.

8. Load test setup **test021.cfg**. Set the synthesizer for 38 kHz at 1 Vrms. For each of the displayed channels, one at a time, attach the synthesizer to one of the channels and shorting plugs to the other one or three channel(s).

   Verify that all shorted channels have no tonal at 38 kHz that exceeds -70 dB.

9. Load test setup **test022.cfg**. Set the synthesizer for 95 kHz at 1 Vrms and attach it to the Channel 1 input BNC connector. Attach a shorting plug to the Channel 2 input BNC connector.

   Verify that any tonal appearing at 95 kHz on Channel 2 is at a maximum signal level of -65 dB.

   Attach the synthesizer to the Channel 2 input BNC connector and attach the shorting plug to the Channel 1 input BNC connector.

   Verify that any tonal appearing at 95 kHz on Channel 1 is at a maximum signal level of -65 dB.

10. Load test setup **test024.cfg**. Set the synthesizer for 250 Hz at 0.60 Vrms. Remove all shorting plugs. Attach the synthesizer to the Channel 1 input BNC connector.

    Verify that the display is updating (indicated by slight flicker and/or movement of the displayed trace).

    Set the synthesizer to 0.55 Vrms.

    Verify that the display is no longer updating.

    Set the synthesizer to 1 Vrms.

    Verify that the display is updating.

    In the ACQUISITION menu, change the trigger source to external.

    Verify that the "Data Not Available" message is displayed.

    Connect a parallel connection from the Channel 1 input BNC connector to the EXT TRIG input.

    Verify that the display is updating.

    Remove the signal from the EXT TRIG input.

    Verify that the display is no longer updating.

11. Load test setup **test025.cfg**. Set the synthesizer for 1 kHz at 20 mVrms. Attach the synthesizer to the inputs of all displayed channels.

    Verify that all channels show a 1 kHz tonal between 19.0 mVrms and 21.0 mVrms.

    Use the Channel Full Scale Controls to change the input Full Scale for all displayed channels to each of the following levels: 50 mVrms, 100 mVrms, 200 mVrms, 500 mVrms, 1 Vrms, 2 Vrms, 5 Vrms, 10 Vrms and 20 Vrms.

    Verify, at each level, that the 1 kHz tonal appears at a level between 19.0 mVrms and 21.0 mVrms.

12. Load test setup **test035.cfg**. Attach the synthesizer to Channels 1 and 2 input BNC connectors. Set the synthesizer for 0-100 kHz swept frequency with a sweep time of 60 seconds and an amplitude of 1 Vrms. On the synthesizer start the sweep function. On the SD390, start the averager by selecting the START function key (F2) and allow it to complete its average (60 seconds).

    At 10 kHz, 30 kHz, 50 kHz and 70 kHz (±2 kHz in each case):

    Verify that the Magnitude transfer function is between 0.97 and 1.03, the phase transfer function is between -1 and +1 degrees and the magnitude of each channel is between -0.9 dBV and +0.1 dBV.

    At 90 kHz (±2 kHz):

    Verify at that the Magnitude transfer function is between 0.95 and 1.05, the phase transfer function is between -2 and +2 degrees and the magnitude of each channel is between -1.0 dBV and +0.2 dBV.

13. If the SD390 has only 2 channels installed skip this step, otherwise:

    Load test setup **test035a.cfg**. Attach the synthesizer to Channels 3 and 4. On the SD390, start the averager by selecting the START function key (F2) and allow it to complete its average (60 seconds).

    At 10 kHz, 30 kHz, 50 kHz and 70 kHz (±2 kHz in each case):

    Verify that the Magnitude transfer function is between 0.97 and 1.03, the phase transfer function is between -1 and +1 degrees and the magnitude of each channel is between -0.9 dBV and +0.1 dBV.

At 90 kHz (±2 kHz)

Verify at that the Magnitude transfer function is between 0.95 and 1.05, the phase transfer function is between -2 and +2 degrees and the magnitude of each channel is between -1.0 dBV and +0.2 dBV.

14. If the SD390 has more than 4 channels then continue with the testing of channels 5 through 8, otherwise proceed to the **Test System Feature** section.

Test Channels 5 through 8

1. If the SD390 has no more than 4 channels installed, then skip this section. Otherwise, attach the synthesizer to the Channel 5 and Channel 6 input BNC connectors.

   If the SD390 has more than 6 channels installed, also attach the synthesizer to the Channel 7 and Channel 8 input BNC connectors.

2. Load test setup **test101.cfg**. Set the synthesizer for a 1 volt rms sine wave at 2000 Hz.

   Verify that the display shows a signal at 2000 Hz and between -0.25 dBV and +0.25 dBV on all displayed channels.

3. Load test setup **test102.cfg**. Change the synthesizer to 10 kHz.

   Verify that the display shows a signal at 10 kHz and between -0.25 dBV and +0.25 dBV on all displayed channels.

4. Load test setup **test105.cfg**. Change the synthesizer to 2 kHz.

   Verify that the display shows a signal at 2 kHz and between -0.25 dBV and +0.25 dBV on all displayed channels.

5. Load test setup **test111.cfg**. Start the averager by selecting the START function key (F2) on the SD390.

   Verify that all tonals other than the 1 kHz primary tonal are at a maximum level of -70 dB on all displayed channels.

6. Load test setup **test112.cfg**. Start the averager by selecting the START function key (F2) on the SD390.

   Verify that all tonals other than the 1 kHz primary tonal are at a maximum level of -70 dB on all displayed channels.

7. Load test setup **test119.cfg**. Set the synthesizer for 1.2 Vrms at 1 kHz.

   Verify that all displayed channels show an overload indication (indicated by the corresponding Channel Overload Indicator going to reverse video).

   Decrease the input level to 1.0 Vrms.

   Verify that all channels are no longer in overload.

8. Load test setup **test121.cfg**. Set the synthesizer for 38 kHz at 1 Vrms. For each of the displayed channels, one at a time, attach the synthesizer to one of the channels and shorting plugs to the other one or three channel(s).

   Verify that all channels which are shorted have no tonal at 38 kHz which exceeds -70 dB.

9. Load test setup **test125.cfg**. Set the synthesizer for 1 kHz at 20 mVrms. Attach the synthesizer to the inputs of all displayed channels.

   Verify that all channels show a 1 kHz tonal between 19.0 mVrms and 21.0 mVrms.

   Use the Channel Full Scale Controls to change the input Full Scale for all displayed channels to each of the following levels: 50 mVrms, 100 mVrms, 200 mVrms, 500 mVrms, 1 Vrms, 2 Vrms, 5 Vrms, 10 Vrms and 20 Vrms.

   Verify, at each level, the 1 kHz tonal appears at a level between 19.0 mVrms and 21.0 mVrms.

10. Load test setup **test135.cfg**. Attach the synthesizer to Channels 5 and 6 input BNC connectors. Set the synthesizer for 0-100 kHz swept frequency with a sweep time of 60 seconds and an amplitude of 1 Vrms. On the synthesizer start the sweep function. On the SD390, start the averager by selecting the START function key (F2) and allow it to complete its average (60 seconds).

    At 10 kHz, 30 kHz, 50 kHz and 70 kHz (±2 kHz in each case):

    Verify that the Magnitude transfer function is between 0.97 and 1.03, the phase transfer function is between -1 and +1 degrees and the magnitude of each channel is between -0.9 dBV and +0.1 dBV.

    At 90 kHz (±2 kHz):

    Verify that the Magnitude transfer function is between 0.95 and 1.05, the phase transfer function is between -2 and +2 degrees and the magnitude of each channel is between -1.0 dBV and +0.2 dBV.

11. If the SD390 has only 6 channels installed skip this step, otherwise:

    Load test setup **test135a.cfg**. Attach the synthesizer to Channels 7 and 8 input BNC connectors. On the SD390, start the averager by selecting the START function key (F2) and allow it to complete its average (60 seconds).

    At 10 kHz, 30 kHz, 50 kHz and 70 kHz (±2 kHz in each case):

    Verify that the Magnitude transfer function is between 0.97 and 1.03, the phase transfer function is between -1 and +1 degrees and the magnitude of each channel is between -0.9 dBV and +0.1 dBV.

    At 90 kHz (±2 kHz)

    Verify at that the Magnitude transfer function is between 0.95 and 1.05, the phase transfer function is between -2 and +2 degrees and the magnitude of each channel is between -1.0 dBV and +0.2 dBV.

Test System Features

1. Perform this step only if the SD390 has the SSG option.

   Load test setup **test203.cfg**. Disconnect the synthesizer and connect the SSG output to Channel 2. In the SETUP menu, select the Noise Gen Option. When the Noise Generator Setup menu is displayed, select OK. Start the noise function by selecting the NOISE START function key (F7) on the SD390.

   Verify, using the Spectrum display, that the overall value (OA) is between 0.95 Vrms and 1.10 Vrms.

2. Perform this step only if the SD390 has the SSG option.

   Load test setup **test203a.cfg**. In the SETUP menu, select the Noise Gen Option. On the Noise Generator Setup menu, select OK. Start the noise function by selecting the NOISE START function key (F7) on the SD390.

   Verify, using the Spectrum display, that the overall value (OA) is between 0.95 Vrms and 1.10 Vrms.

3. Perform this step only if the SD390 has the SSG option.

   Load test setup **test204.cfg.** In the SETUP menu, select the Sine Gen Option. On the Sine Generator Setup window, select OK. In the Spectrum display select the S function. In the AXES SETUP window ensure that the scale for the Y Axis Max is set to 1 and then select OK. Start the sine function by selecting the SINE START function key (F7) on the SD390.

Verify that there is no overload for Channel 2.

Verify, using the Spectrum display, that only one tonal appears and that it has a minimum of 900 mv across the entire sweep.

Verify that the time required for the tonal to make one complete sweep is between 39 and 41 seconds.

4. Perform this step only if the SD390 has the SSG option.

   Load test setup **test204a.cfg**. In the SETUP menu, select the Sine Gen Option. On the Sine Generator Setup window, select OK. Start the sine function by selecting the SINE START function key (F7) on the SD390.

   Verify that there is no overload for Channel 2.

   Verify, using the Spectrum display, that only one tonal appears and that it has a minimum of 850 mv across the entire sweep.

   Verify that the time required for the tonal to make one complete sweep is between 78 and 82 seconds.

5. Load test setup **test205.cfg**. For all available channels attach one 50 ohm terminator per channel pair and connect Channel 1 to Channel 2, Channel 3 to Channel 4, Channel 5 to Channel 6, and Channel 7 to Channel 8.

   Verify that all displayed dc amplitudes are between 175 millivolts and 225 millivolts.

6. Load test setup **test206.cfg.**

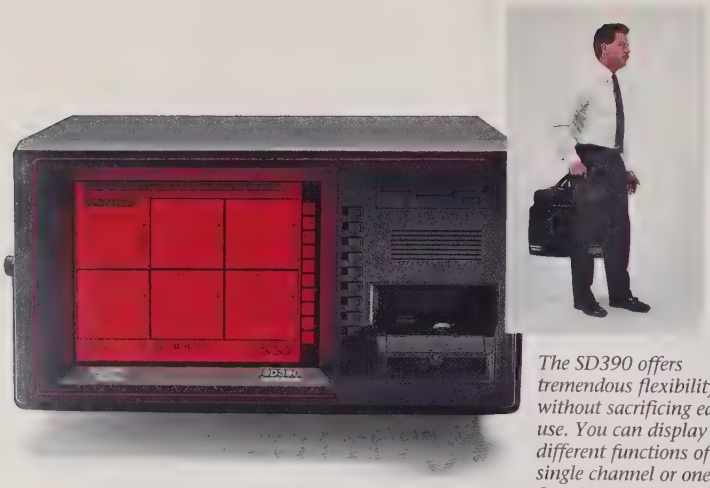
   Verify that all displayed DC amplitudes are between 175 millivolts and 225 millivolts.

This concludes the Field Calibration VerificationTest.

NOTES

Scientific Atlanta
Instrumentation Group

Dynamic Signal Analyzer Model SD390



The SD390 offers tremendous flexibility without sacrificing ease of use. You can display nine different functions of a single channel or one function each from eight different channels. The choice is yours.

Features

- Frequency range of dc to 100 kHz for measurement flexibility
- Selectable resolutions of 200, 400, 800 or 1600 spectral lines
- Fast signal analysis with two-channel 20 kHz real-time rate
- 16-bit analog-to-digital converter with 32-bit floating point processing for exceptional performance
- Microsoft® Windows™ graphical user interface
- Hard disk drive with options up to 120 MB and 3.5-inch 1.44 MB floppy disk drive
- Expandable from standard two channels to four, six or eight parallel input channels
- Built-in high resolution graphics with 11-inch VGA gas plasma display
- Complete function control with integral trackball and softkeys
- Integrated self-test on startup
- Supports optional PC peripherals: VGA monitors, printers, plotters, mouse, keyboard and modems
- Rugged, lightweight design for portable use
- Unique real-time, multi-channel waterfall displays with up/down, profiling, recording and variable skew
- Optional full digital Signature Ratio® Analysis (SRA) for order tracking
- Optional 100 kHz Signal Source (SSG) with sine, swept sine, random, burst random, pink and white noise output
- Optional full digital octave and one-third octave acoustic analysis (ANSI S1.11-1986)

Dynamic Analysis Made Simpler

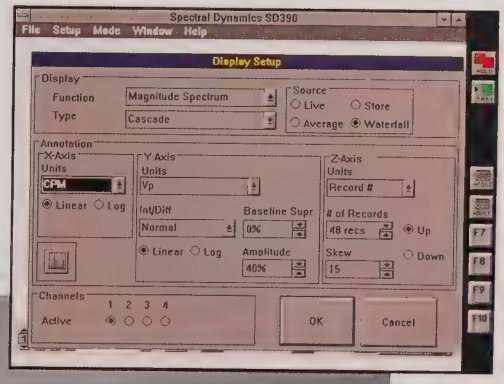
Whether you're using a spectrum analyzer for testing, analysis or measurements, you need quick access to critical information in a format you can use. You want to focus on solving the problem – not spend hours learning pushbutton sequences or searching for hidden menus. These tools should save you time and simplify your work, not make it more complex.

Scientific-Atlanta combined advanced hardware technology and user-friendly software to create the SD390, a dynamic signal analyzer that allows you to begin solving problems in minutes, not days. The SD390 provides you with the fastest multi-channel, real-time analysis capability in the industry, along with an intuitive user interface that guides you through each measurement. The on-line help system contains a complete interactive reference to all features.

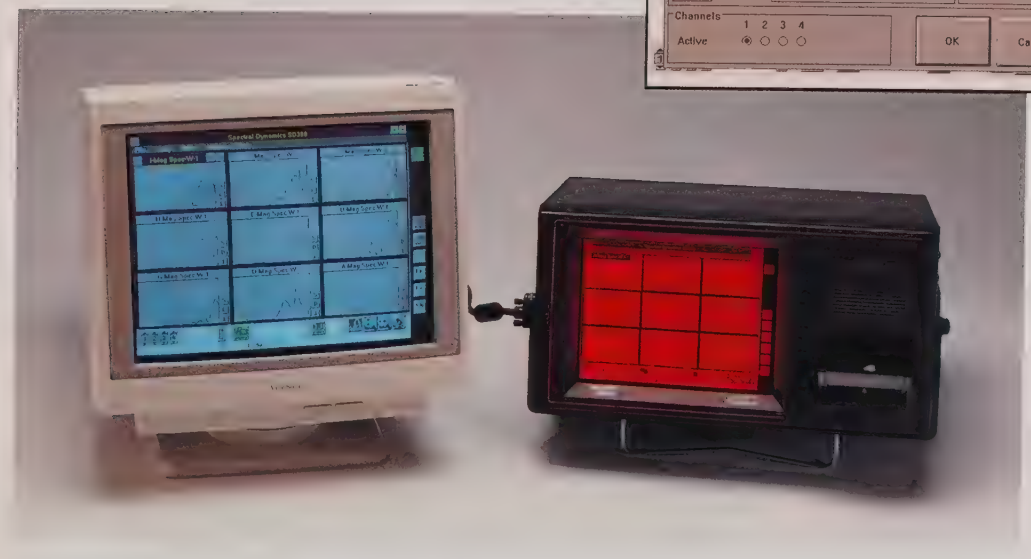
The SD390 Dynamic Signal Analyzer provides all the measurement tools you need, regardless of the application. It requires no external processing hardware, is small enough to fit into the overhead bin on most airliners, and weighs less than 27 lbs. (12.3 kg). At the job site, setup takes only minutes.

The multiprocessor design can include up to 15 separate primary processing devices, to keep the SD390 at the leading edge of technology for years. Modular architecture allows upgrades to any part of the instrument as your needs change and expand. Plus, the SD390 uses the Microsoft® Windows™ user interface for seamless integration with other industry-standard software applications.

The SD390 Dynamic Signal Analyzer offers flexibility without sacrificing ease of use. You can bring as many as nine separate displays on the screen at one time, independent of the channel inputs and each other. You can display nine different functions of a single channel or one function each from eight different channels. This allows you to mix and match time traces, spectrum functions or three-dimensional cascade displays from different channels.



Easy setups let you point and click your way to advanced analysis features.



The SD390 offers the flexibility of multiple channels, plus a high resolution external color display option. In addition, user-defined measurement setups can be recalled from disk or changed on-line to perform a test.

Multiple Applications Made Easy

In every application, the design and engineering of the SD390 Dynamic Signal Analyzer make it a pleasure to use. Whether you need to maintain equipment, manufacture cost-effective products, fine tune designs, perform tests, or simply make measurements, you will find the SD390 is ready and able to assist you.

Around the world, Scientific-Atlanta's SD390s are hard at work in steel mills, engine and transmission factories, electronics companies, power plants, laboratories, law enforcement facilities, universities and design centers.

Automotive industry customers use Scientific-Atlanta signal analyzers to design and test engines as well as mechanical parts and structures. They are used also to monitor interior noise and vibration.

In the aerospace industry, the SD390 is used to design and test jet engines, space vehicles, guidance systems and avionics.

Oil, gas and petrochemical plants use our analyzers to help monitor critical equipment for signs of wear or malfunction as part of their preventive maintenance programs.

Machinery Diagnostics And Maintenance

Solving machinery problems requires an analyzer that is both portable enough to go to the machine and powerful enough to do real analysis when it gets there. It's not sufficient to collect raw data – you need superior tools to solve problems on site.

The SD390 incorporates the industry's most complete set of functions for machinery analysis including:

- Multiple orbit and waterfall displays
- Transducer power (ICP®) and normalization
- Signal integration/differentiation
- Computed order tracking for accurate bin-centered spectrum displays with the Signature Ratio option
- Multiple marker modes
- Channel math

Testing complex rotating machines like the engine of an F-22 jet fighter is simplified with 6 to 8 channels to acquire data and the ability to display all channels at one time.

Intuitive software in the SD390 make measuring resonance, phase and damping easy. The ability to run balancing and alignment programs inside the analyzer, with as many as eight parallel inputs, makes it the premier analyzer for machinery diagnostics and maintenance.

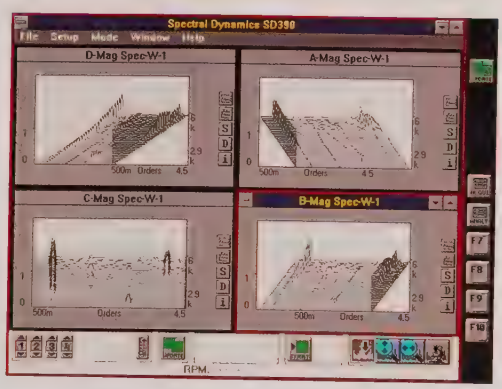
Machinery diagnostic functions include:

- Tracking vibration problems as machines change speed
- Zooming in on bearing and gearbox vibration problems
- Monitoring sleeve bearing motion using displacement sensors and displaying multiple shaft orbits
- Utilizing amplitude, RPM and phase readouts for multiplane balancing
- Measuring bearing and gear faults
- Identifying process machine defects

Waterfall Display

The SD390 includes state-of-the-art cascade or three-dimensional waterfall displays. Many functions processed by the SD390, including transfer functions, coherence and cross-spectra, can be presented as waterfall displays as well as the standard narrowband, third-octave and full-octave spectrum presentations.

Several key factors contribute to making this the most flexible waterfall display ever. The speed at which the waterfall memory is loaded occurs at the internal processing rate, rather than the display update rate. Therefore, spectra can be loaded into the waterfall memory as fast as once every seven milliseconds. In addition, the waterfall memories can be expanded to store more than 4,500 narrowband spectra or 45,000 third-octave spectra. Multiple waterfall displays are easily established.



Signature Ratio Analysis and waterfall functions provide for powerful machine analysis.

Order-related waterfall displays can serve as the first step toward identifying a complete RPM tracking display for each significant harmonic order of running speed. All processed results stored in the waterfall memory are in a precision floating-point data format. Once stored, spectrum data can be changed from linear to log format and expanded for display purposes in either axis.

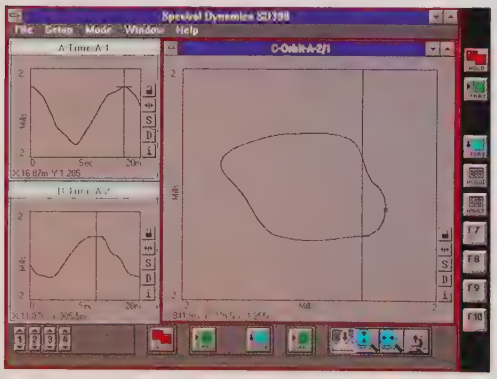
The SD390 offers simultaneous viewing of several cascade displays representing different input channels, or a cascade display together with several resulting z-axis profiles. Features like selectable gain, a complete choice of record size, flexible post-processing, and variable skew to eliminate hidden data and to boost low level signal visibility, can help you get the most from your data.

Signature Ratio Analysis for Computed Order Tracking

Signature Ratio Analysis is a unique signal processing and display technique developed by Scientific-Atlanta. It is a method of acquiring and processing data from variable speed machinery and results in a bin-centered order spectrum display of amplitude versus order of rotation.

The computed order tracking technique introduced in the SD390 offers a host of new features. For fast machine runups, data and tachometer signals are stored in a unique "play-back" memory. High resolution spectrum analysis is then performed at selected RPM increments which can range from a few to several hundred records.

The SD390's analysis gives highly accurate spectral presentations at the RPM increments most valuable to you. Order tracking displays are just a "click" away with up to nine simultaneous presentations of order versus RPM.



The SD390's multiple screen presentation provides detailed orbit displays for analysis of shaft motion, bearings and oil whirl. Additional diagnostic information on displacement, RPM and balancing requirements can also be displayed simultaneously.

Electronic Measurements And Digital Signal Processing

The SD390 has the frequency range, input capabilities and outstanding signal-to-noise ratio to make it ideal for electronic and signal processing measurements. A variety of input sources, from simple component checks to complex waveform analysis, can be used to perform measurements. The SD390 offers a selection of analysis functions and displays, plus a choice of weighting windows and overlap factors.

Tremendous display and measurement flexibility, along with outstanding performance, speed and easy report generation make the SD390 very popular for electronic measurements. The advanced suite of functions makes component and subsystem measurements simple.

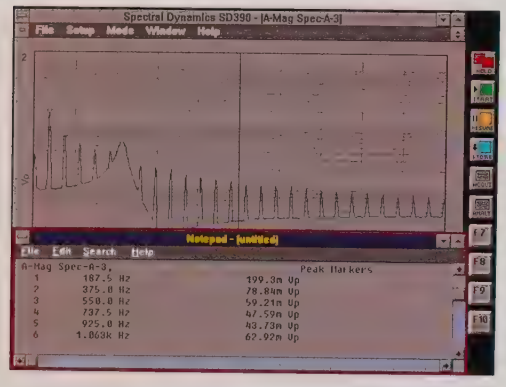
Transient capture and extended recording, with detailed display expansion and playback capability, assures that nothing escapes detection. Triggered averaging and multiple waterfall presentations not only clean up noisy signals, but present the results in a clear fashion.

Electronic Measurement Applications Include:

- Filter frequency response analysis
- Signal stability measurement
- Modulation characteristics, harmonics and distortion determination
- Device noise and signal characteristics
- Transient capture and analysis
- Power spectral density computation
- Synchronous averaging

Markers and List Functions

When you need to get detailed information on specific data points, nothing beats the SD390's markers and list capabilities.


Spectral Dynamics SD390 - [A-Mag Spec-A-3]
File Setup Mode Window Help
Notepad - (untitled)
File Edit Search Help
A-Mag Spec-A-3, Peak Markers
1 187.5 Hz 199.3m Up
2 375.0 Hz 78.84m Up
3 550.0 Hz 59.21m Up
4 737.5 Hz 47.59m Up
5 925.0 Hz 43.73m Up
6 1.063k Hz 62.92m Up

The markers and list functions give precise numerical readouts and allow you to integrate results directly into your reports.

You can choose peaks above a set value, the maximum amplitude peak, harmonics, a tracking cursor, or define your own markers. Any marker you use can be listed numerically with x- and y-axis values and units. This list is automatically placed on the Windows™ Notepad and allows you to insert the listed values in any other program using the "Paste" function. With these features you can quickly mark a value, have it automatically recorded, and insert it into a report on demand.

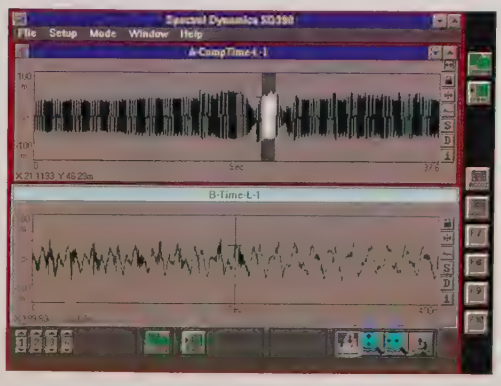
Math Functions Made Simpler

Combine the exceptional display flexibility of the SD390 with its mathematical functions, and you get a virtually unlimited combination of ways to examine your data.

Math functions allow you to easily add, subtract, multiply, divide, multiply by a constant, take the square root of, integrate, or differentiate spectra. The intuitive controls let you perform channel mathematics faster and easier than ever before.

Extended Recording

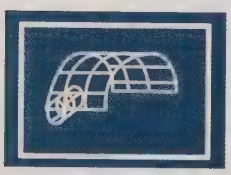
Built into every SD390 is a digital data recorder. This real-time memory serves as a recirculating buffer which can capture entire events – transient or continuous.



The input memory of the SD390 allows up to 1.8 million samples of time data to be stored.

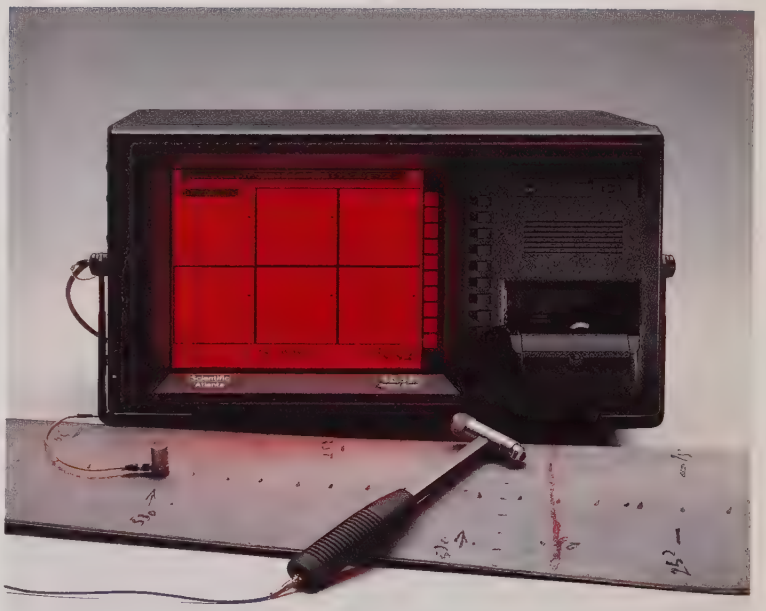
With a standard memory size of 400,000 samples (and an optional 1.8 million samples), this memory can be observed while it is loaded in real-time. Then, data can be played back and processed or expanded for even the most detailed examination. The contents of the memory can then be transferred to one of the analyzer's internal disks for permanent data storage.

Regardless of size, the extended recorder memory functions as a continually rotating buffer. Therefore, even if you are not viewing the extended input memory, updated input signals are passing through and being recorded. As a result, the operator can, at any time, freeze input sampling, display the extended input memory, and observe data captured during the last few milliseconds, seconds or minutes. Post-processing of captured data can then be made with selectable spectrum resolution, windowing and overlap processing factors.



Structural And Modal Analysis

The frequency response function (transfer function) is the primary relationship describing the output and input characteristics of a mechanical, electrical or biological system. These functions allow you to solve resonance problems that can reduce equipment life.



All transfer functions can be displayed at one time with the flexible display system in the SD390.

Transfer function displays can be scaled to meet the intent of the measurement from just a few decibels to literally hundreds of decibels full-scale across the entire screen. Added to this, the combination of input auto ranging and output display auto scaling assures that the transfer function measurements you make will take maximum advantage of available signal-to-noise and dynamic range.

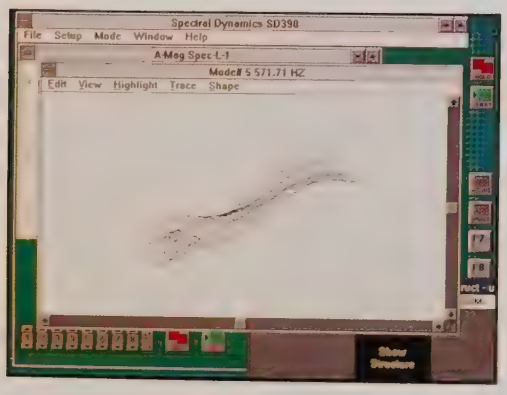
Multiple frequency response functions can be displayed simultaneously in a variety of formats including magnitude, phase, coherence, vector components or Nyquist. Of course, components of

the transfer function can be displayed in a waterfall format as well. This gives the operator a real-time look at deflection patterns from transfer functions taken at various structural locations, or used as parametric studies observing how a transfer function might change as a function of a third variable, such as current flow, temperature or pressure.

Mechanical Impedance (MZ) measurements are easily performed with the SD390 to investigate physical parameters of materials or non-linear response phenomenon. Accelerance (A/F), Mobility (V/F), Compliance (D/F), Dynamic Mass (F/A), Impedance (F/V) and Dynamic Stiffness (F/D) functions versus frequency can be displayed simultaneously on the SD390. The corresponding phase display for each MZ function is available as well.

SMS StarModal®

The frequency response functions measured by the SD390 are often just one step in the complete dynamic analysis of a mechanical system. To understand the behavior of the structure completely, it is useful to create a mathematical model of the test structure.

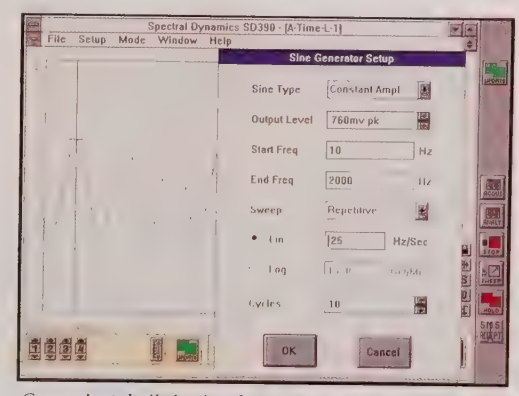


The SD390 provides the ONLY single-unit workstation solution for complete modal analysis.

The excellent frequency response function measurement capability of the SD390 can be combined with popular analysis programs to create complete dynamic models for such analysis requirements as the detection of resonant frequencies or the measurement of damping factors. For example, data can be exported to SMS StarModal with one button using the SD390 SMS Software Driver.

Signal Generator

The SD390 has a versatile built-in signal generator option activated by a simple point-and-click selection on a Windows-driven pull-down menu.



Convenient, built-in signal source provides multi-function output independent of other analyzer functions.

Signal outputs include both fixed frequency and swept sine waveforms, as well as various types of continuous and burst noise signals. These outputs are optimized for the clocking and frequency ranges of the analyzer.

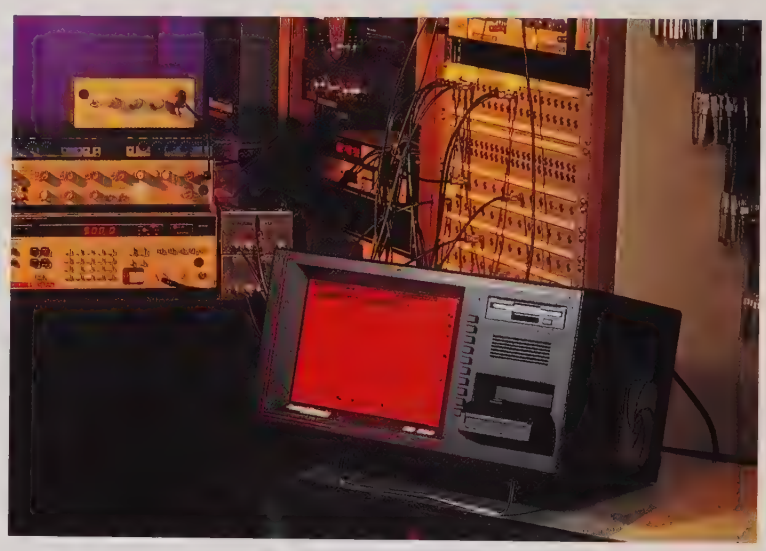
However, once the signal source has been specified and activated, it functions independently. This means that any frequency range or processing function can be selected while the signal source continues to operate in the background.

Therefore, a wider frequency range than that selected for signal excitation can be chosen for analysis, thus permitting on-line distortion measurements if the signal is used to excite an external device. In general, frequency response function measurements are greatly enhanced using this versatile signal source.

Acoustic Analysis

The SD390 implements an all digital technique for full-octave and third-octave acoustic measurements, eliminating the restrictions inherent in older narrowband synthesis techniques. Accurate and repeatable analysis can be performed on steady state or transient noise signals on a real-time basis and viewed as a live or three-dimensional cascade spectrum display. Simultaneous third-octave analysis can be performed on multiple inputs, significantly reducing measurement times.

Noise regulations often require product compliance testing with sound pressure levels measured with either flat, A, B, C or D acoustic weighting curves, all of which are included in the SD390. Amplitude values can be displayed in dBR relative to a known calibration reference. Acoustic spectrums can be presented in 11 full-octave or 33 full third-octave filter bands in one display.



Eight parallel input channels make complex data analysis and reduction with the SD390 much faster than before.

Digital octave processing meets and exceeds ANSI S1.11-1986 specifications for superior accuracy.

Connectivity and Software

The SD390 is the first integrated analysis tool designed for connectivity with industry standard peripherals, as well as for easy use with off-the-shelf software products. It is the only analyzer that allows you the flexiblity of multitasking other software programs with your analyzer. The SD390 can also run many useful software programs that can enhance its post-processing capability, like Excel® and MathCAD®.

The terminal program included with the SD390 and a modem can be used to send data across long distances. Controlling the SD390 from a remote location is simple with the remote control option. This allows an expert hundreds or even thousands of miles away to assist the user on-site.

Dedicated engineering software can be used to process your data from the SD390. Compatibility is provided for the SMS StarModal and StarAcoustics programs with a specialized driver and function key built into the analyzer. Data export is available in ASCII format which allows the use of hundreds of third-party analysis and calculation programs.

The SD390, which provides built-in ICP power, can be used with the SD25-380 to make torsional measurements and to extend your analysis capabilities. A wide variety of sensor inputs and strategies can be used also.

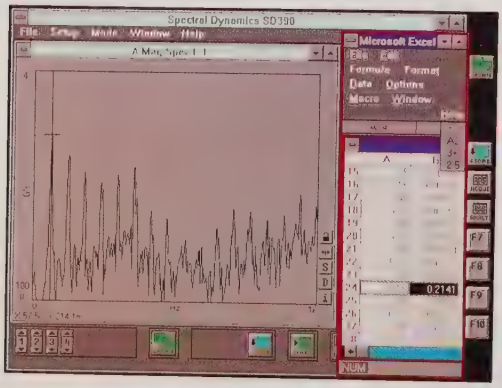
Serial and parallel printers and plotters can be connected quickly and are provided with Microsoft® Windows™ driver support. Hardware options for imbedded computer support currently include Intel® 80386DX and 80486DX microprocessors as well as new generation processor options for future applications.

The SD390 can connect to hundreds of standard hardware devices including the SD43-GPT Fiber Optic Tachometer, the SD1800 Random Vibration Controller and the SD215 Spectral Guardian Production Test Analyzer.

Report Generation

The final result of using measurement equipment is often a report detailing the analysis and findings. The SD390 simplifies this reporting process so you can concentrate more on performing the measurements and less on preparing the report.

In its basic format you can command the SD390 to print from one to nine spectrum displays with your own annotation for each display. To generate a more sophisticated report, you can use a word processing program (one is built right into the SD390), add a spreadsheet like Excel, a mathematics program like MathCAD, or a post-processing analysis program for modal, structural or finite element analysis. With the SD390 you even have the option to write a program yourself using Visual® Basic.



SD390 data can be exported and displayed in seconds using a spreadsheet program.

The SD390's powerful analysis and data export functions make report generation a simple process, no matter what type of program you use. It is supported by the world's most popular computer operating system and graphical user interface, MS-DOS® and Microsoft® Windows ™.

All of these tools serve to multiply the analysis power of the SD390. This supercharged integration allows you to customize the output of your analyzer to a degree not previously available.

Cost Effective Solutions

For over 30 years, customers have relied on Scientific-Atlanta for superior testing and measurement equipment that is cost effective and has excellent technical support. Today, thousands of organizations worldwide use our advanced signal processing instruments for a broad range of applications.

Total Support

Scientific-Atlanta offers products and customer support which match your needs and expectations. Service options range from full warranties and startup assistance to technical support and professional training.

Specialized training seminars are your keys to enhancing the SD390's power. The Spectral Institute teaches advanced techniques and methods to use with the SD390 Dynamic Signal Analyzer. Courses cover a variety of topics in the fields of signal analysis, sound and vibration.

Training can be performed at your facility or at scheduled seminars.

Scientific-Atlanta's Quality Service Program is available at our San Diego manufacturing site or through authorized service sites throughout the world. Upgrades, maintenance, calibrations and on-site support are offered to fit your needs.

A wide range of services from 24-hour on-site support to Scientific-Care contracts providing on-site calibration services and maintenance support are offered. Services include:

- Complete warranty protection and service
- Scientific-Care for total maintenance and calibration coverage
- Time and material service for contracts at discounted rates
- Upgrade service to meet your new testing and measurement requirements
- Responsive service for 24-hour, standby, field and replacement parts support

Scientific-Atlanta product, service and applications support is there when you need it.

Signature Ratio is a registered trademark of Scientific-Atlanta, Inc. All other trademarks and registered trademarks are the properties of their respective owners.

System Specifications

Number of channels
Two, four, six or eight
Frequency ranges
dc to 100 kHz full scale in 1, 2, 4, 5 sequence, less 50 kHz range, two channels active
dc to 40 kHz full scale 1, 2, 4, 5 sequence, four to eight channels active
A/D conversion
16 bit resolution
DSP operation
32 bit, 40 MHz floating point primary processor
16 bit secondary processor for each channel pair
Dynamic range
> 80 dB with 8 averages on 0.05 Vrms to 20 Vrms
Noise floor > 90 dB below full scale 0.1 V to 20 V full scale
Real-time performance
> 20 kHz real-time rate on dual channel operation
Full scale voltage range
0.01 Vrms to 20 Vrms in 1, 2, 5 sequence with autoranging
Input impedance
1 MΩ shunted by less than 100 picofarads
Input coupling
dc or ac (-3 dB @ 0.5 Hz)
Constant current power (ICP)
4 mA constant current, 24 V dc maximum, selectable each channel
Overload protection
100 V pk input on each channel
Triggering
Internal — selectable for any channel, single or repeat
External — single or repeat
Frequency resolution
200, 400, 800 or 1600 lines selectable
Input recorder memory
Standard 385K samples
Optional 1,850K samples
Weighting functions
Rectangular, Hanning, harris flat-top, Exponential with variable tau, and selectable offset
Overlap processing
Max overlap in real-time mode; selectable 0, 25, 50, 75, 90 or maximum for averaging or extended memory readout
Averaging modes
Sum, Expo, Peak, +1, Swept sine frequency response

Model SD390

Floppy disk drive
- Built-in 3.5-inch microfloppy drive, standard 1.44 MB format MS-DOS®

Hard disk drive
- 40 MB standard, 120 MB (optional)

Workstation CPU and memory
- 4 MB with 80386 standard
- 8 MB with 80486 (optional)

X-axis readouts
- Hz, RPM and seconds, and orders (optional)

Y-axis readouts
- Volts, EU, dB, dBV and dBR with modifiers of magnitude, magnitude squared and magnitude squared/Hz. User defined labels for EU up to 5 characters. Calculated and displayed dB Ref

Phase offset
- ±180° or 0° - 360°

Cursors/markers
- Locked cursors for like displays selectable

X-value
- Minimum and maximum, overall, peaks above threshold, maximum peak track, user defined

Transducer sensitivities

mV/EU	0.001 to 10,000
dB Ref	0 to 200
Vref	1e-9 to 20
EU label	user defined (up to 6 characters)

Functions Performed

Time
- Input memory for any channel or group (variable block length)
- Compressed input memory (up to 770 kB) for any channel
- Sync time average for any channel, orbit display, 1 vs. 2, etc.

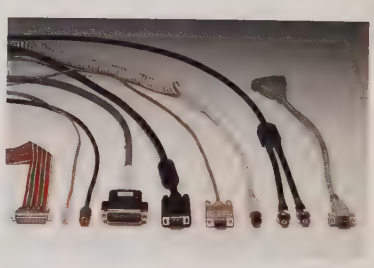
Spectrum
- Narrowband real-time, baseband or zoom
- Average display, baseband or zoom
- Sync spectrum average display

Cross spectrum
- Magnitude
- Phase
- Real and imaginary

Cross properties
- Transfer function (any channel selectable as reference)
- Magnitude
- Phase
- Coherence
- Real and imaginary
- Nyquist
- Mechanical impedance

Math operations
- Differentiation and integration in EU
- Double differentiation and integration in EU
- Sum
- Product
- Difference
- Ratio
- Square
- Square root

Standard ports for
- Mouse
- Parallel printer
- External keyboard
- VGA monitor
- RS-232 serial



Full VGA display
- 640 x 480 display lines

Display windows
- One to nine displays, user configurable size, aspect and location
- User selectable grids or ticks, linear and logarithmic

Zoom

Mode
- Real-time or average

Frequency span
- Selectable from 5 Hz to 40 kHz in a 1, 2, 4, 5 sequence
- Span center frequency: selectable from 3 Hz to 99.8 kHz in 1 Hz increments (center frequency limits are dependent upon frequency span)

Waterfall

Number of waterfall channels
- 1 to 8 active

Source data
- Real-time or averaged frequency domain data

Waterfall display types
- Cascade
- Single record
- Peak hold envelope
- Profile (any frequency or SRA order)
- Profile overall level

Baseline suppression
- Programmable in 1% amplitude increments

Waterfall display skew
- ±45°, ±30°, ±15° and 0°

Octave Analysis (-41 Option)

Conforms to ANSI S1.11-1986, Order 3, Type 1D, extended and additional frequency ranges

Dynamic range
- 70 dB down from full scale typical (1/3 octave)

Display ranges
- 1/1 octave, 11 bands
- 1/3 octave, 33 bands

Acoustic Weighting
- Flat, A, B, C or D on all channels

Signal Source Generator (-15 Option)

Analog output signals
- Pseudo random
- White noise
- Pink noise
- Burst random
- Swept sine
- Sine dwell

Sweep rates and cycles
- Linear
  - 1.0 to 999 Hz/second
- Logarithmic
  - 0.1 to 10 octaves/minute single, repetitive, up and down from 1-99 cycles

Signature Ratio (-16 Option)

Selectable orders
- 1 to 200 full scale

Maximum input voltage
- ±20 V peak

Tachometer frequency range
- 1 to 5000 Hz

Tachometer tracking range
- 300 RPM to 120,000 RPM, user-defined by start and stop RPM values set

Tachometer trigger threshold
- ±0.5 V peak

Minimum tachometer pulse width
- 10 microseconds

Tachometer readout accuracy
- ±0.1% of true RPM or ±1 RPM, whichever is greater

Tachometer pulses per rev
- 0.5 to 999 (selectable to 3 decimal places)

Tracking ratio
- 16 to 1 over selected RPM interval

Display types
- Three-dimensional cascade display
- Peak hold envelope spectrum of entire array
- Selected single spectrum; amplitude vs. order
- Profile overall level vs. RPM
- Profile selected order vs. RPM

(start and stop RPM independently selectable for each display)

Physical Characteristics

Dimensions
- 17.25 in. W x 9 in. H x 13 in. D
- (43.8 cm W x 22.9 cm H x 33 cm D)

Weight
- 27 lbs. (typical)
- (12.3 kg)

Power
- 115/230 V ac, 50-60 Hz

Environmental Characteristics

Temperature
- 5° C to 45° C operating
- -10° C to 60° C nonoperating

Humidity
- 80 % noncondensing

Shock and vibration
- Operational, -5 g's, halfsine, 11 ms pulse

Vibration
- 5 Hz to 27 Hz at 0.025 DA, 28 Hz to 500 Hz at 0.5 Gpk

Ordering Information

SD390 -2 two channel
32 bit DSP with 1 MB memory
1.44 MB floppy disk drive
40 MB hard disk drive, 32 bit host processor
4 MB host memory
VGA gas plasma display
Integral trackball
Serial (RS-232C) port
Mouse port and parallel port

-4	Same as -2 with four channels
-6	Same as -2 with six channels and 4 MB DSP memory
-8	Same as -2 with eight channels and 4 MB DSP memory
-11	Mouse
-12	Keyboard
-15	Signal Source Generator (SSG)
-16	Signature Ratio Analysis (SRA)
-20	Softside case
-21	Hardside case
-23	230 V operation
-31	32 bit integral coprocessor host CPU 80486-33, 8 MB host RAM and 120 MB hard disk drive
-32	4 MB DSP memory option (for two-or four-channel configurations)
-35	External VGA monitor (115 V only)
-41	Octave analysis option
-42	SMS Star driver option
-51	SMS StarModal software
-52	SMS StarAcoustic software
-53	SMS StarStruct software
-56	Microsoft Excel software
-57	MathCAD software
-58	Remote control option (RS-232 remote control includes software and 25 ft./7.5 M serial cable)
-59	Microsoft Word for Windows software

Specifications and product availability are subject to change without notice.

Scientific Atlanta

Our customers are the winners.

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